YAMAHA

YAMAHA MOTOR CO., LTD.

YAMAHA Tool for Optimizing Parameters RD series

TOP

User's Manual

ENGLISH E

E98-Ver. 1.03

Note to the user

Keep this manual handy so that anyone using this software can easily refer to it when needed.
Before installing and operating "TOP for Windows" (hereafter called "TOP software" or "TOP"), read this manual carefully to understand RD series functions and comply with its safety information, precautions, and operating and handling instructions.
Always use the TOP software while staying within the specification limits stated in this manual.

About this manual

- The contents of this manual are subject to change without prior notice.
- Carefully keep this manual because it will not be reissued.
- This manual must not be reproduced or reprinted in part or in whole without our permission.
- Every effort was made to ensure that this manual is accurate and complete. However, please contact us if you notice any errors, omissions or dubious points.
- Please note that we accept no responsibility for any results that might occur from use of this manual or the unit described in it.
- The TOP software runs on a PC (personal computer) that is connected to the YAMAHA robot driver RD series, and does not operate independently. When operating a robot, read the robot and robot driver user's manuals thoroughly as well as this manual. Ensure safety and then start operating the robot.
- Windows, Windows NT, and Windows 2000 are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

Safety precautions

To use this software correctly and safely, always read this manual and all other attached documents carefully before use. Use this software only after you are thoroughly familiar with its features and functions, safety information and precautions.

This manual classifies safety caution items into the following alert levels, using the signal words "DANGER" and "CAUTION".

DANGER

INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury or damage to the equipment or software.

Note that some items described with "CAUTION" might lead to serious results depending on the situation. In any case, always observe the above instructions and precautions since they provide important safety information.
After reading this manual, always store it where the operator can easily refer to it any time when needed.

Precautions when connecting/disconnecting the cable

CAUTION

1. **When connecting or disconnecting the PC cable from the robot driver, make sure that both the robot driver and PC are turned off.
   Connecting or disconnecting the PC cable while power is still supplied may cause the robot driver and/or PC to malfunction.**
2. **Never disconnect or connect the PC cable to the robot driver while the TOP software is running.
   If reconnecting the PC cable to the robot driver, always first quit the TOP software. Then reconnect the cable and restart the TOP software.
   Failure to follow this procedure might cause the TOP software and PC to malfunction.**

Precautions during use

CAUTION

1. **When the robot driver control power is turned off, always quit the TOP software and then restart it.
   Unless you quit the TOP software, the TOP software and PC might malfunction when the control power is turned back on.**
2. **Do not turn off the robot driver control power while initialization or parameter rewriting is in progress.
   The EEPROM data (stored data) in the robot driver might be destroyed if the control power is turned off during write operation, causing the robot driver to malfunction.**

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Chapter 1 How to install

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1. Installing the TOP software

1.1 Check before installation

Before installing the TOP software, make the following checks:

(1)Hard disk space

Before beginning installation, check that the hard disk where you will install the TOP software has at least 30MB of free space.

(2)PC and OS

Check that the PC and OS meet the following requirements:

PC	: Computer with Pentium or 100% compatible processor
OS	: Microsoft Windows 95 or later, or Windows NT 4.0 or later
Memory	: 32 MB or more (recommended)
CD-ROM drive	: 4x or higher speed (recommended)
Graphic display	: 800×600 pixels, 32000 or more colors (recommended)
Serial communication port	: 1 or more port

Adobe Acrobat Reader 6.0 or later should be installed in the PC.

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*Adobe and Acrobat Reader are registered trademarks of Adobe Systems Incorporated in the United States and/or other countries.

*Pentium is a registered trademark of Intel Corporation in the United States and/or other countries.

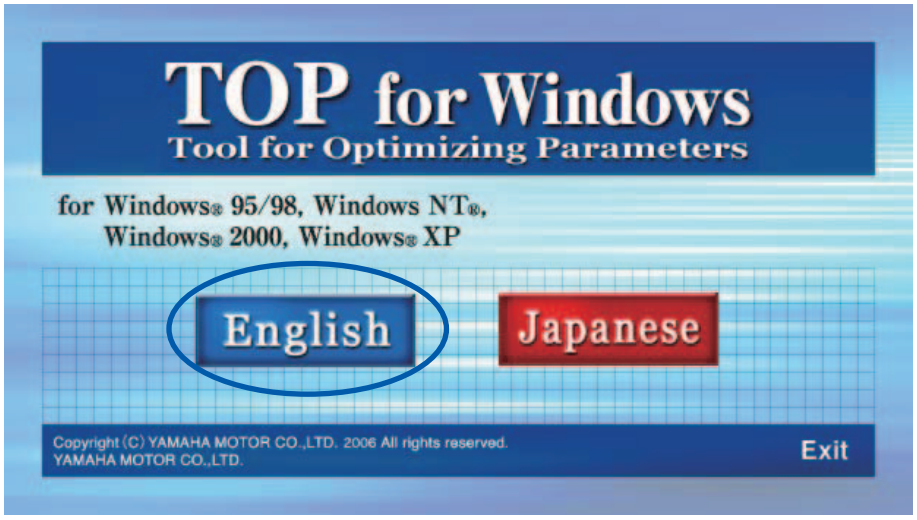
1.2 Installing the TOP software

1. Start Windows.
   (The following steps are explained using Windows XP screens.)

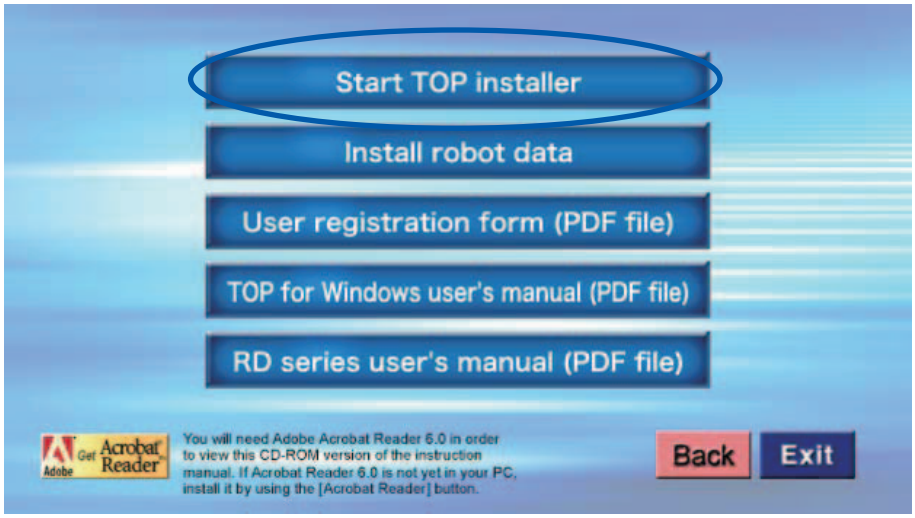
2. Quit unnecessary resident programs.
   (Software installation might become unstable or fail if a resident program is running.)

3. Insert the CD-ROM containing the TOP software into the CD-ROM drive.
   The setup program will automatically start up. (If it does not start up, open the CD-ROM drive icon and double-click "ToPforWinLaunch" to start the setup program.)

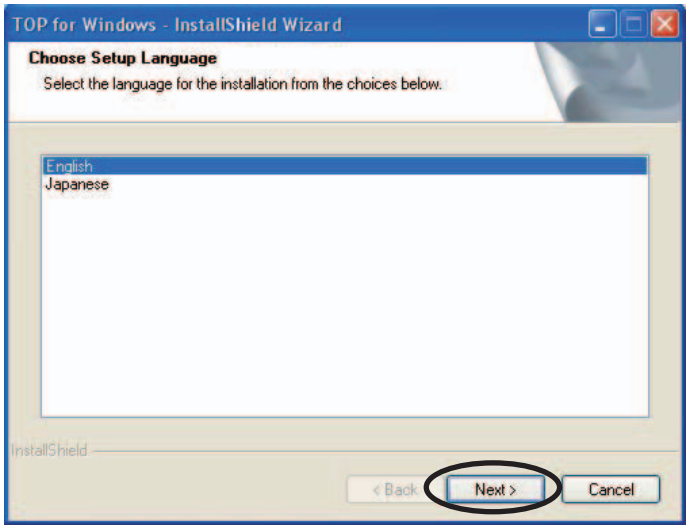
4. The following screen appears when the setup program starts.
   Click the [English] (or [Japanese]) button to select the menu language.



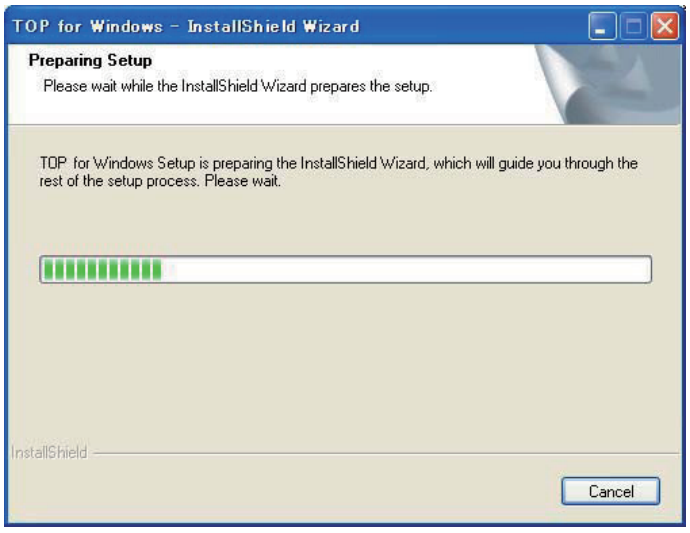
5. The following menu screen then appears.
   Click the [Start TOP installer] button.

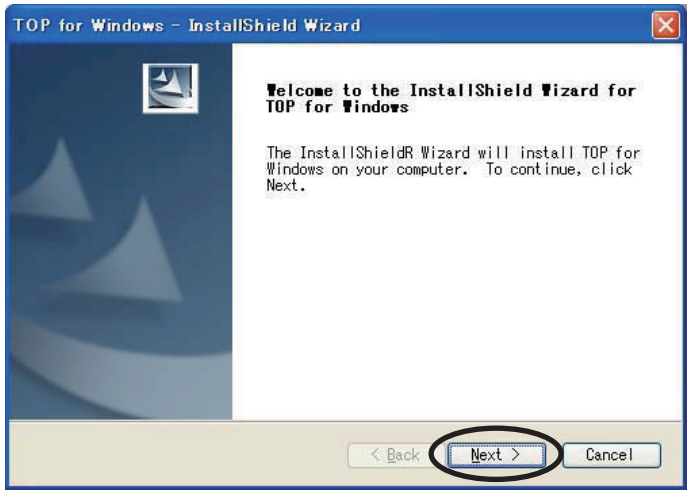

Start TOP installer
Install robot data
User registration form (PDF file)
TOP for Windows user's manual (PDF file)
RD series user's manual (PDF file)
Get Acrobat Reader
You will need Adobe Acrobat Reader 6.0 in order to view this CD-ROM version of the instruction manual. If Acrobat Reader 6.0 is not yet in your PC, install it by using the [Acrobat Reader] button.
Back
Exit

6. The following dialog box then appears.
   Select the language you want to use with the TOP software and click the [Next] button.

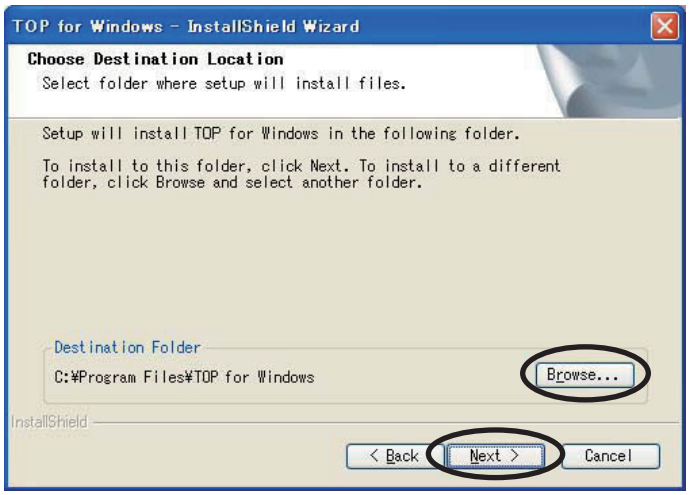


7. The following dialog box appears showing the progress of installation preparation. Another screen then appears when the preparation is complete. Click the [Next] button to continue installation.

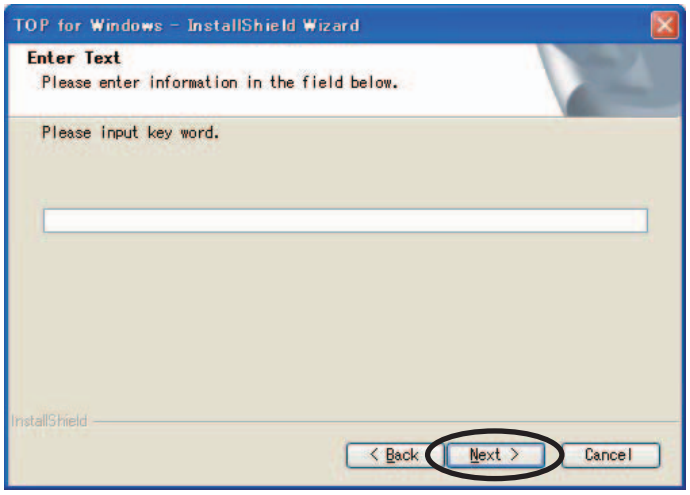

TOP for Windows - InstallShield Wizard
Preparing Setup
Please wait while the InstallShield Wizard prepares the setup.
TOP for Windows Setup is preparing the InstallShield Wizard, which will guide you through the rest of the setup process. Please wait.
InstallShield
Cancel


TOP for Windows - InstallShield Wizard
Welcome to the InstallShield Wizard for TOP for Windows
The InstallShield® Wizard will install TOP for Windows on your computer. To continue, click Next.
< Back
Next >
Cancel

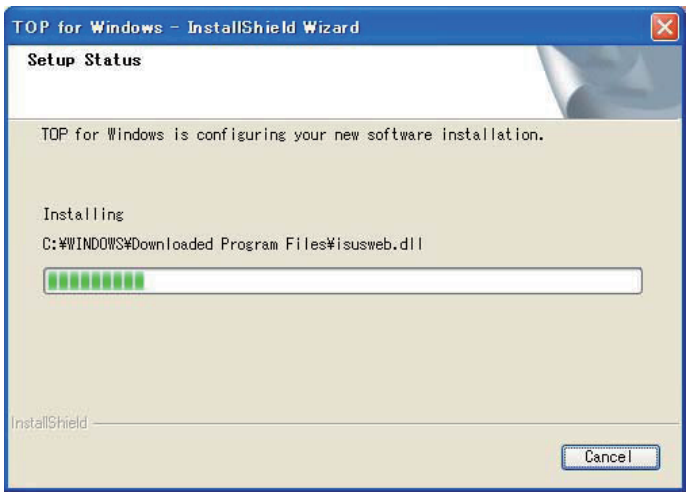
8. When the following screen appears, select the folder where the TOP software will be installed.
   If you want to change the default destination folder, click the [Browse] button and specify the folder to install the software.
   After selecting the folder, click the [Next] button.


TOP for Windows - InstallShield Wizard
Choose Destination Location
Select folder where setup will install files.
Setup will install TOP for Windows in the following folder.
To install to this folder, click Next. To install to a different folder, click Browse and select another folder.
Destination Folder
C:¥Program Files¥TOP for Windows
Browse...
InstallShield
< Back
Next >
Cancel

9. Click the [Next] button without entering anything.



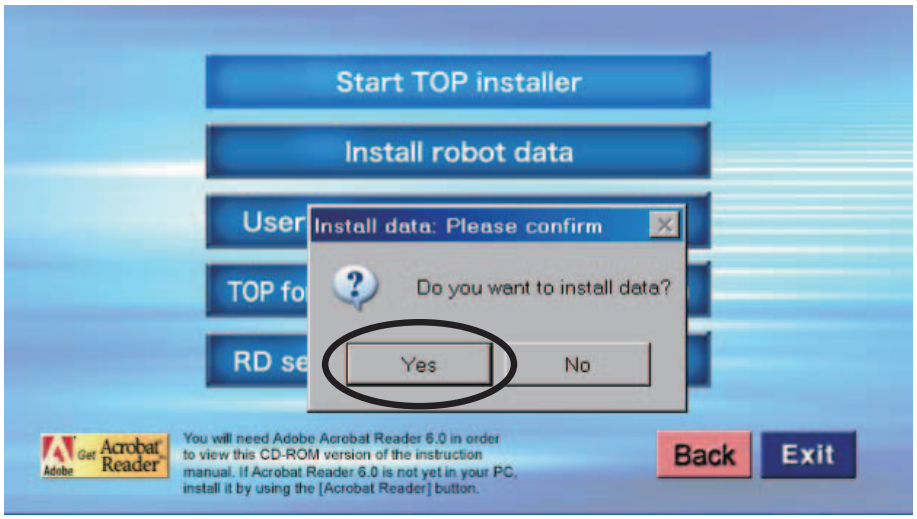
10. The installer starts installing the software.



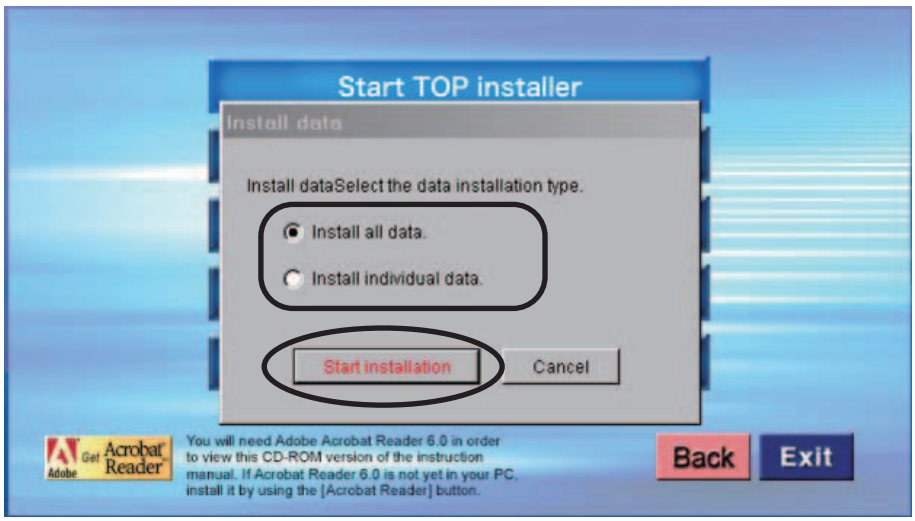
The following screen appears when the installation is complete. Click the [Finish] button.

TOP for Windows - InstallShield Wizard
InstallShield Wizard Complete
The InstallShield Wizard has successfully installed TOP for Windows. Click Finish to exit the wizard.
< Back
Finish
Cancel

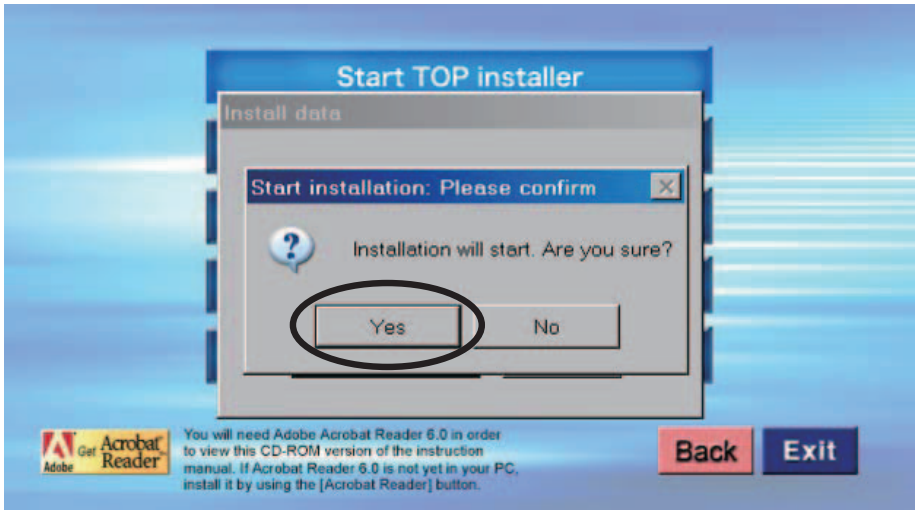
11. The following dialog box then appears.
Click the [Yes] button to install robot data.

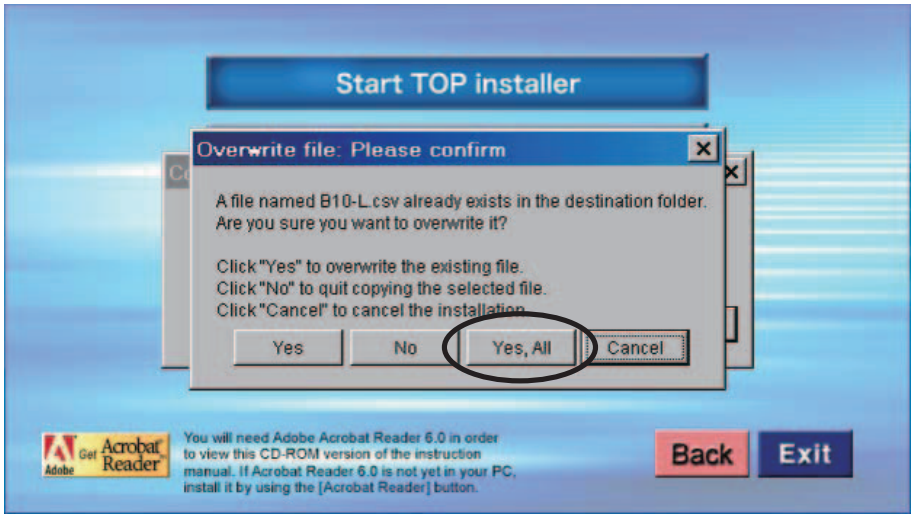

Start TOP installer
Install robot data
User
TOP fo
RD se
Install data: Please confirm
Do you want to install data?
Yes
No
Get Acrobat Reader
You will need Adobe Acrobat Reader 6.0 in order to view this CD-ROM version of the instruction manual. If Acrobat Reader 6.0 is not yet in your PC, install it by using the [Acrobat Reader] button.
Back
Exit

12. The "Install data" dialog box then appears.
Select "Install all data" or "Install individual data", and click the [Start installation] button.

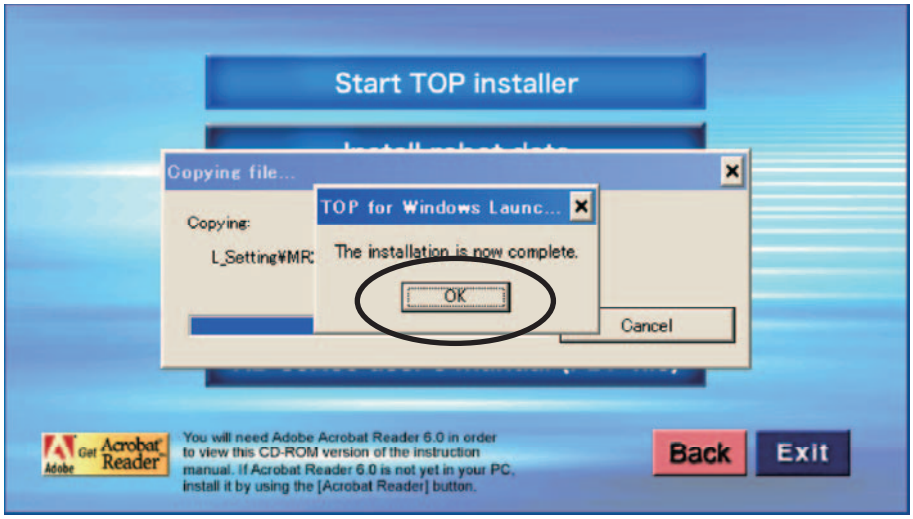

Start TOP installer
Install data
Install dataSelect the data installation type.
Install all data.
Install individual data.
Start installation
Cancel
Get Acrobat Reader
You will need Adobe Acrobat Reader 6.0 in order to view this CD-ROM version of the instruction manual. If Acrobat Reader 6.0 is not yet in your PC, install it by using the [Acrobat Reader] button.
Back
Exit

13.A confirmation dialog box appears.
Click the [Yes] button to start installing data.


Start TOP installer
Install data
Start installation: Please confirm
Installation will start. Are you sure?
Yes
No
You will need Adobe Acrobat Reader 6.0 in order to view this CD-ROM version of the instruction manual. If Acrobat Reader 6.0 is not yet in your PC, install it by using the [Acrobat Reader] button.
Back
Exit


Start TOP installer
Overwrite file: Please confirm
A file named B10-L.csv already exists in the destination folder.
Are you sure you want to overwrite it?
Click "Yes" to overwrite the existing file.
Click "No" to quit copying the selected file.
Click "Cancel" to cancel the installation.
Yes
No
Yes, All
Cancel
You will need Adobe Acrobat Reader 6.0 in order to view this CD-ROM version of the instruction manual. If Acrobat Reader 6.0 is not yet in your PC, install it by using the [Acrobat Reader] button.
Back
Exit

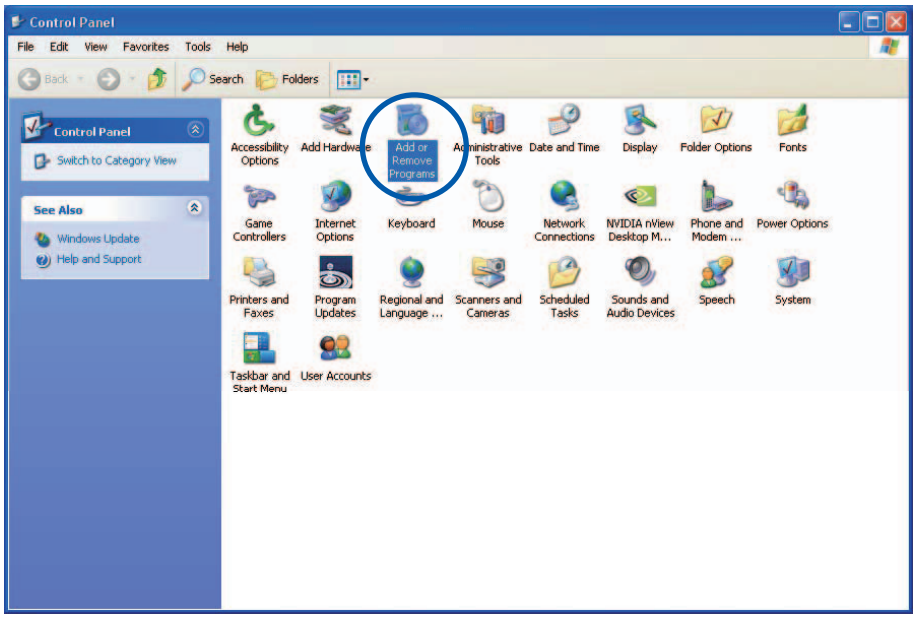
14.The following dialog box appears when the installation is complete.
Click the [OK] button.


Start TOP installer
Copying file...
Copying:
L_Setting¥MR:
TOP for Windows Launc...
The installation is now complete.
OK
Cancel
You will need Adobe Acrobat Reader 6.0 in order to view this CD-ROM version of the instruction manual. If Acrobat Reader 6.0 is not yet in your PC, install it by using the [Acrobat Reader] button.
Back
Exit

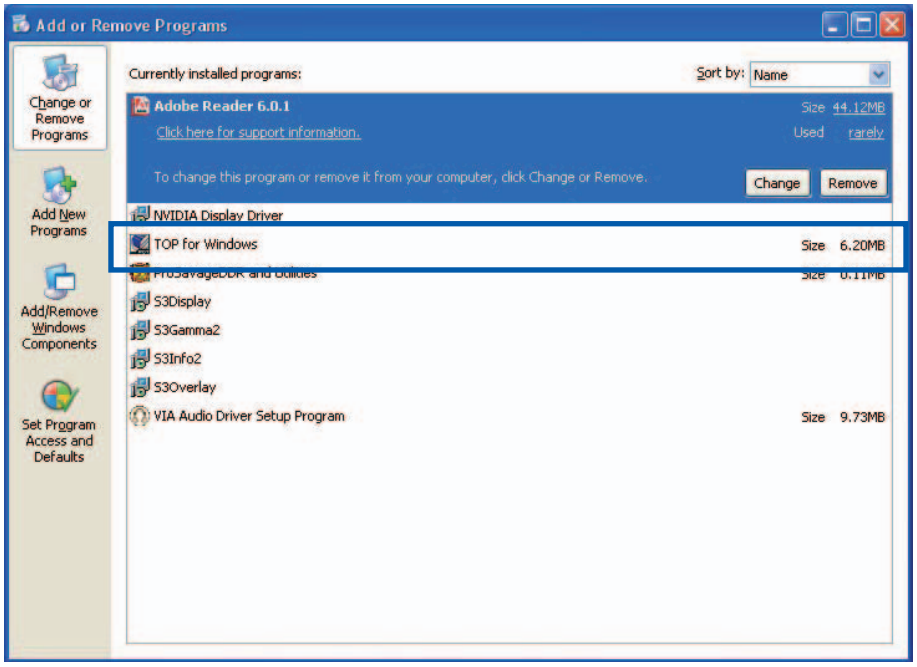
1.3 Uninstalling the TOP software

Use the following procedure to uninstall the TOP software. (The procedure is explained using Windows XP screens.)

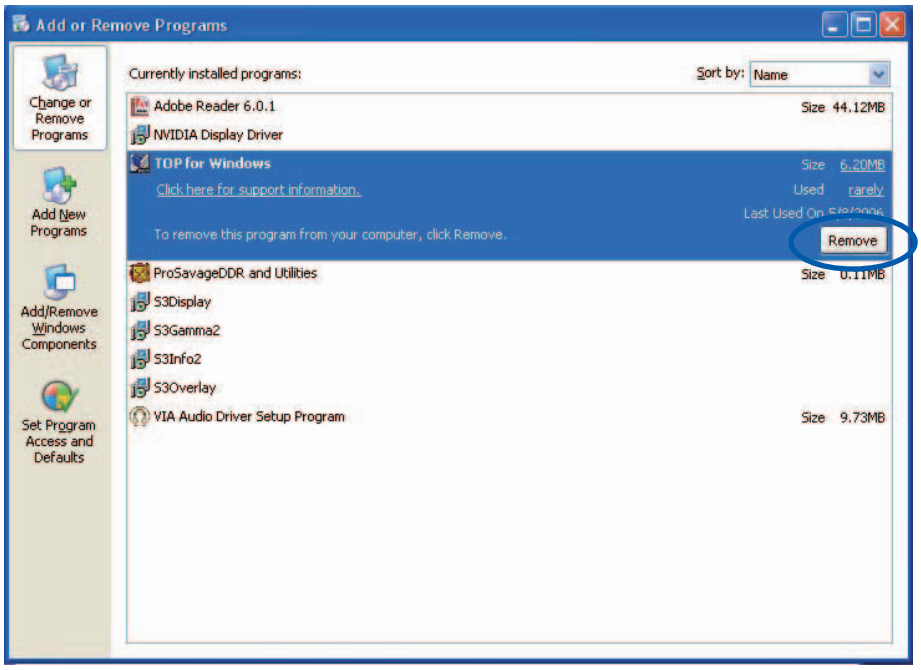
1. Open the "Control Panel" and double-click the [Add or Remove Programs] icon.



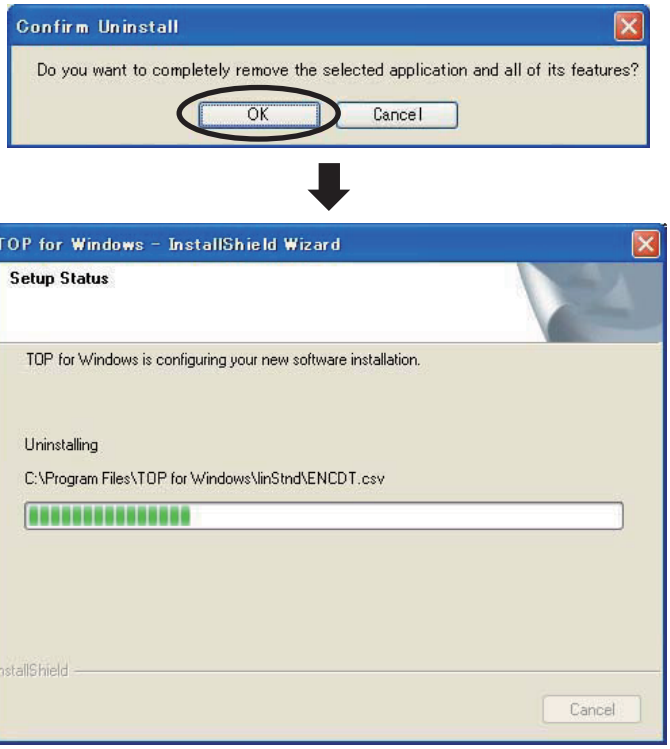
2. When the list of installed programs appears, select the [Change or Remove Programs] icon on the left side.
   Scroll the list of programs as needed and select "TOP for Windows".



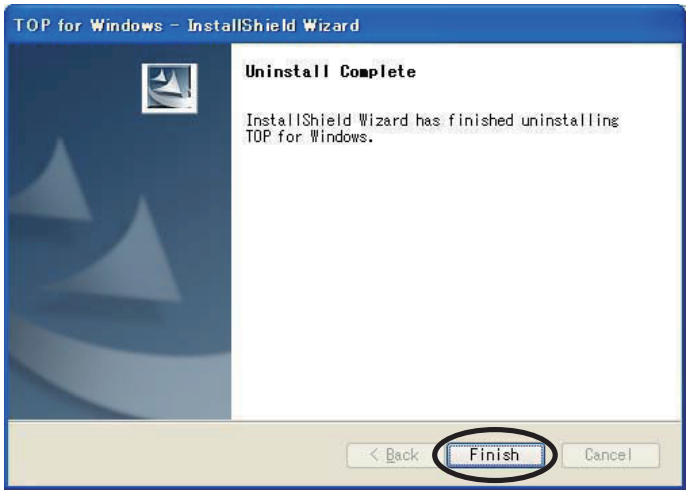
3. After selecting "TOP for Windows", click the [Remove] button.



4. The uninstall program starts and the following message then appears. Click the [OK] button to start removing the TOP software.



5. The following screen appears when the software has been removed. Click the [Finish] button to end the uninstallation.



1.4 Upgrading the software version

To upgrade the TOP software, first uninstall the current version as described in the previous section and then install the new version.
Please contact us for information on the latest version and software version upgrading.

MEMO

Chapter 2 Connecting to the robot driver

This chapter describes the cable for connecting the PC to the robot driver and explains how to make the connection.

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2.2 Connecting to the robot driver 2-2

2. Connecting to the robot driver

Precautions when connecting/disconnecting the cable

CAUTION

1. When connecting or disconnecting the PC cable from the robot driver, make sure that both the robot driver and PC are turned off.
   Connecting or disconnecting the PC cable while power is still supplied may cause the robot driver and/or PC to malfunction.
2. Never disconnect or connect the PC cable to the robot driver while the TOP software is running.

Precautions during use

CAUTION

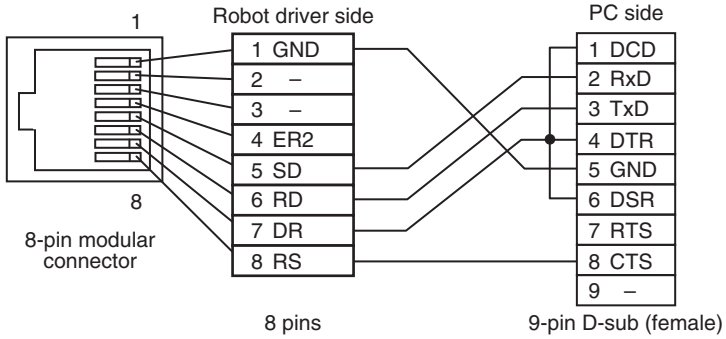
1. When reconnecting the PC cable to the robot driver, always first quit the TOP software.
   Then reconnect the cable and restart the TOP software.
   Failure to follow this procedure may cause the TOP software and PC to malfunction.
2. Do not turn off the robot driver control power while initialization or parameter rewriting is in progress.
   The EEPROM data (stored data) in the robot driver might be damaged if the control power is turned off during write operation, causing the robot driver to malfunction.

The following sections explain the PC connection cable and how to make the connection.

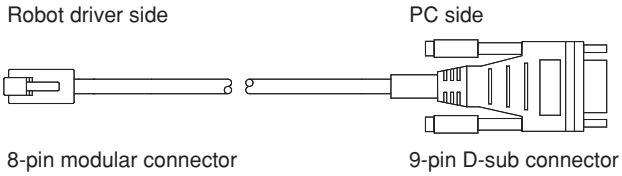
2.1 Connection cable

Assemble the connection cable as shown in the wiring diagram below, or use the assembled PC cable as shown below.

Wiring diagram



PC cable



2.2 Connecting to the robot driver

Using the above-mentioned cable, connect the PC to the robot driver.

Robot driver : Front panel connector marked "PC"

PC : RS-232C port

Chapter 3 Operating Procedures

This chapter describes how to start and exit the TOP software, monitor operation, make parameter setups, perform operation trace and test runs, and change the communication format.

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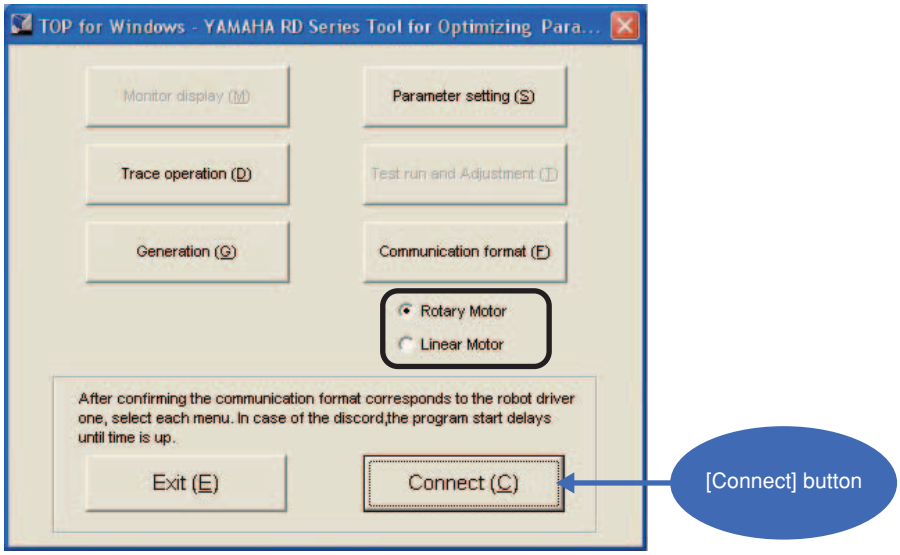
3. Operating Procedures

3.1 Starting and exiting

3.1.1 Starting the TOP software

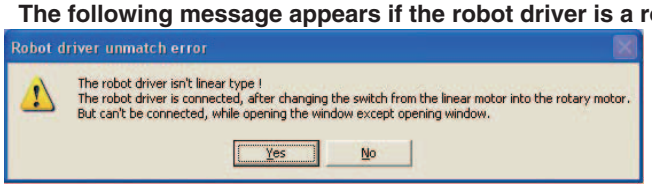
1. From the Start menu on the Windows taskbar, select "Programs" (or "All Programs"), point to "TOP for Windows" and click "TopWin".

2. The software then starts and displays the opening screen.

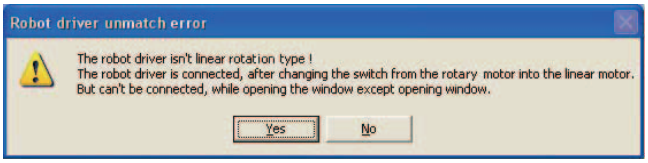

TOP for Windows - YAMAHA RD Series Tool for Optimizing Para...
Monitor display (M)
Parameter setting (S)
Trace operation (D)
Test run and Adjustment (T)
Generation (G)
Communication format (F)
Rotary Motor
Linear Motor
After confirming the communication format corresponds to the robot driver one, select each menu. In case of the discord,the program start delays until time is up.
Exit (E)
Connect (C)
[Connect] button

< If the wrong motor type was selected >

The following message appears if the robot driver is a rotary motor type.


Robot driver unmatch error
The robot driver isn't linear type !
The robot driver is connected, after changing the switch from the linear motor into the rotary motor.
But can't be connected, while opening the window except opening window.
Yes
No

The following message appears if the robot driver is a linear motor type.


Robot driver unmatch error
The robot driver isn't linear rotation type !
The robot driver is connected, after changing the switch from the rotary motor into the linear motor.
But can't be connected, while opening the window except opening window.
Yes
No

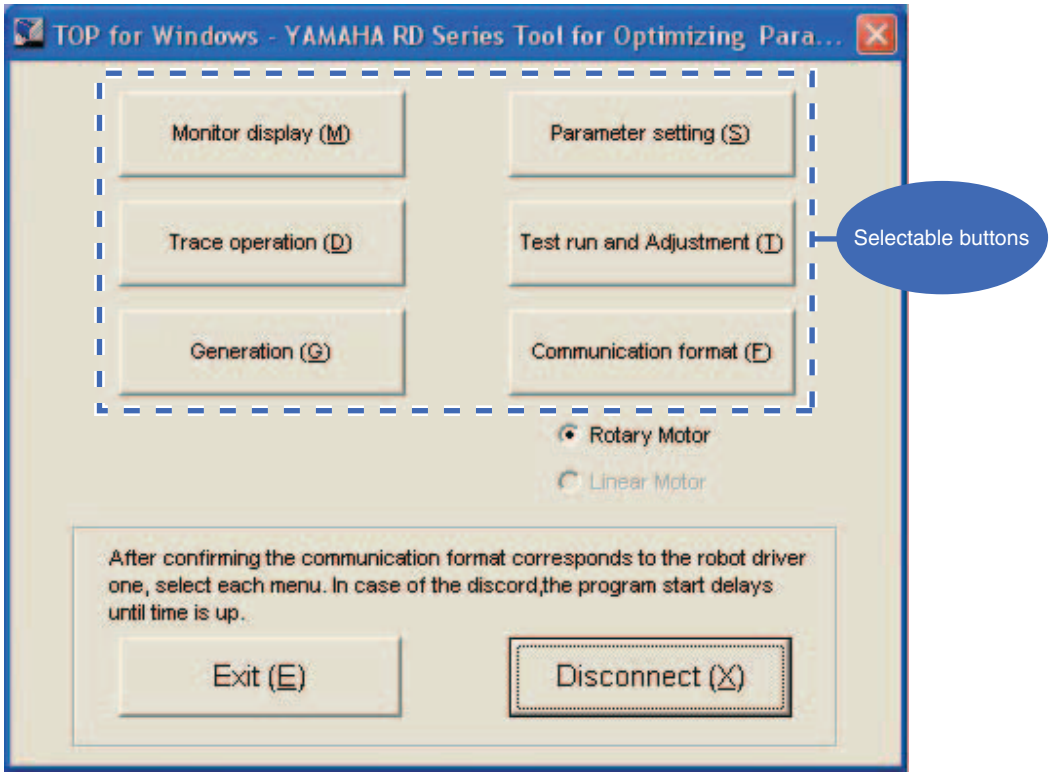
Clicking the [Yes] button automatically changes to the correct type and connects to the robot driver.
Clicking the [No] button cancels the connection.

Note 1: The PC will not connect to the robot driver if any screen other than the opening screen is already displayed.

Note 2: Applicable robots for the RD series robot drivers are as follows:
(See the robot driver user's manual for detailed information.)
RDX-05, RDX-10, RDX-20 .... Robot drivers for rotary motor
RDP-05, RDP-10, RDP-20 .... Robot drivers for linear motor

3. Click the [Connect] button to connect to the robot driver.
When connected correctly, the screen changes as shown below after a few seconds to make more buttons available on the opening screen. The [Connect] button also changes to [Disconnect] button.

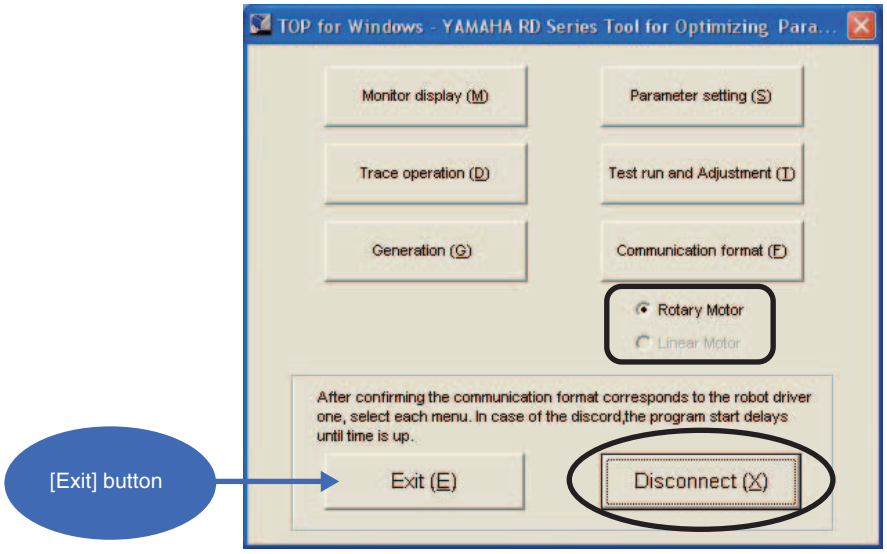
If failed to connect correctly, see section 4.1, "If failed to connect to the robot driver".


TOP for Windows - YAMAHA RD Series Tool for Optimizing Para...
Monitor display (M)
Parameter setting (S)
Trace operation (D)
Test run and Adjustment (T)
Generation (G)
Communication format (F)
Selectable buttons
Rotary Motor
Linear Motor
After confirming the communication format corresponds to the robot driver one, select each menu. In case of the discord,the program start delays until time is up.
Exit (E)
Disconnect (X)

3.1.2 Exiting the TOP software

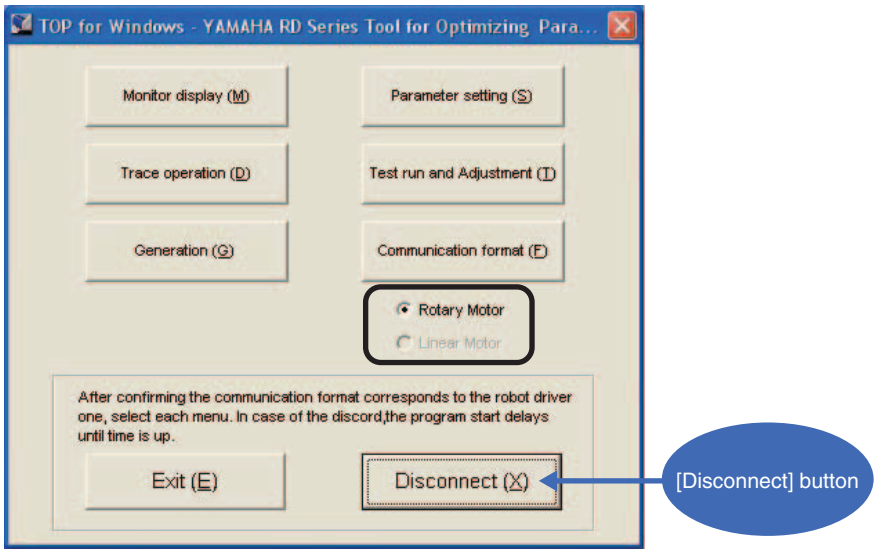
(1)To exit the TOP software

1. Close all open screens except the opening screen.
2. Click the [Disconnect] button if currently connected to the robot driver.
3. Click the [Exit] button on the opening screen.


TOP for Windows - YAMAHA RD Series Tool for Optimizing Para...
Monitor display (M)
Parameter setting (S)
Trace operation (D)
Test run and Adjustment (T)
Generation (G)
Communication format (F)
Rotary Motor
Linear Motor
After confirming the communication format corresponds to the robot driver one, select each menu. In case of the discord,the program start delays until time is up.
Exit (E)
Disconnect (X)
[Exit] button

(2)To disconnect the communication

1. Close all open screens except the opening screen.
2. Click the [Disconnect] button on the opening screen.


TOP for Windows - YAMAHA RD Series Tool for Optimizing Para...
Monitor display (M)
Parameter setting (S)
Trace operation (D)
Test run and Adjustment (T)
Generation (G)
Communication format (F)
Rotary Motor
Linear Motor
After confirming the communication format corresponds to the robot driver one, select each menu. In case of the discord,the program start delays until time is up.
Exit (E)
Disconnect (X)
[Disconnect] button

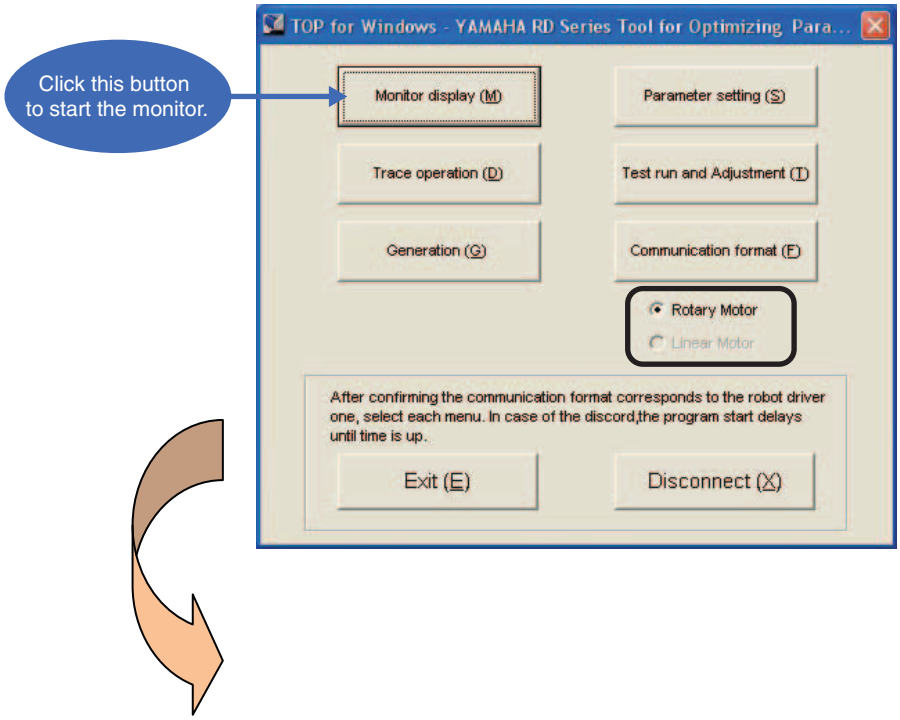
Note: The motor type cannot be changed as long as a screen (such as "Parameter setting" screen) other than the opening screen is displayed. Close such that screen if displayed.

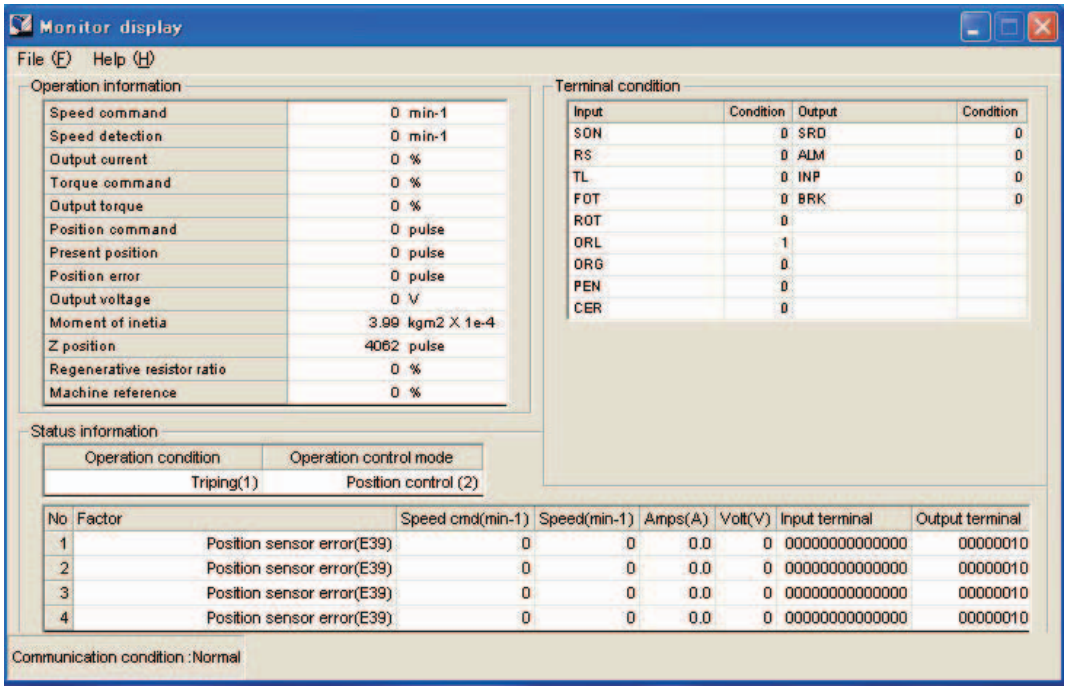
3.2 Monitor function

The monitor function allows you to check operation information in real time.

3.2.1 Starting the monitor function

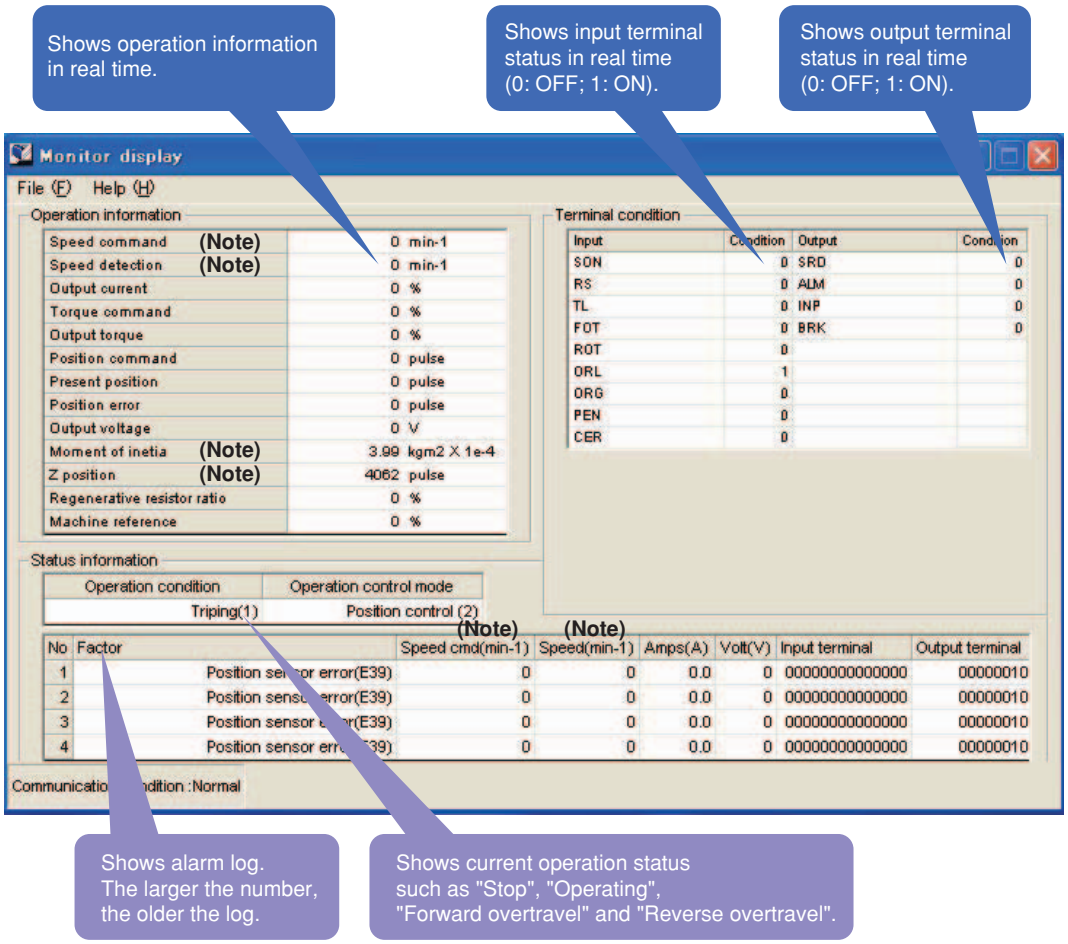
Click the [Monitor display] button on the opening screen.
The "Monitor display" window then appears as shown below.


Click this button to start the monitor.
TOP for Windows - YAMAHA RD Series Tool for Optimizing Para...
Monitor display (M)
Parameter setting (S)
Trace operation (D)
Test run and Adjustment (T)
Generation (G)
Communication format (F)
Rotary Motor
Linear Motor
After confirming the communication format corresponds to the robot driver one, select each menu. In case of the discord,the program start delays until time is up.
Exit (E)
Disconnect (X)


Monitor display
File (F) Help (H)
Operation information
Speed command 0 min-1
Speed detection 0 min-1
Output current 0 %
Torque command 0 %
Output torque 0 %
Position command 0 pulse
Present position 0 pulse
Position error 0 pulse
Output voltage 0 V
Moment of inetia 3.99 kgm2 X 1e-4
Z position 4062 pulse
Regenerative resistor ratio 0 %
Machine reference 0 %
Terminal condition
Input Condition Output Condition
SON 0 SRD 0
RS 0 ALM 0
TL 0 INP 0
FOT 0 BRK 0
ROT 0
ORL 1
ORG 0
PEN 0
CER 0
Status information
Operation condition Operation control mode
Triping(1) Position control (2)
No Factor Speed cmd(min-1) Speed(min-1) Amps(A) Volt(V) Input terminal Output terminal
1 Position sensor error(E39) 0 0 0.0 0 00000000000000 00000010
2 Position sensor error(E39) 0 0 0.0 0 00000000000000 00000010
3 Position sensor error(E39) 0 0 0.0 0 00000000000000 00000010
4 Position sensor error(E39) 0 0 0.0 0 00000000000000 00000010
Communication condition :Normal

3.2.2 Monitor display window description

The "Monitor display" window is described below.


Shows operation information in real time.
Shows input terminal status in real time (0: OFF; 1: ON).
Shows output terminal status in real time (0: OFF; 1: ON).
Monitor display
File (F) Help (H)
Operation information
Speed command (Note) 0 min-1
Speed detection (Note) 0 min-1
Output current 0 %
Torque command 0 %
Output torque 0 %
Position command 0 pulse
Present position 0 pulse
Position error 0 pulse
Output voltage 0 V
Moment of inetia (Note) 3.99 kgm2 X 1e-4
Z position (Note) 4062 pulse
Regenerative resistor ratio 0 %
Machine reference 0 %
Terminal condition
Input Condition Output Condition
SON 0 SRD 0
RS 0 ALM 0
TL 0 INP 0
FOT 0 BRK 0
ROT 0
ORL 1
ORG 0
PEN 0
CER 0
Status information
Operation condition Operation control mode
Triping(1) Position control (2)
(Note) (Note)
No Factor Speed cmd(min-1) Speed(min-1) Amps(A) Volt(V) Input terminal Output terminal
1 Position sensor error(E39) 0 0 0.0 0 00000000000000 00000010
2 Position sensor error(E39) 0 0 0.0 0 00000000000000 00000010
3 Position sensor error(E39) 0 0 0.0 0 00000000000000 00000010
4 Position sensor error(E39) 0 0 0.0 0 00000000000000 00000010
Communication condition :Normal
Shows alarm log. The larger the number, the older the log.
Shows current operation status such as "Stop", "Operating", "Forward overtravel" and "Reverse overtravel".

Note: Items shown here vary depending on which motor type is selected, as shown in the table below.

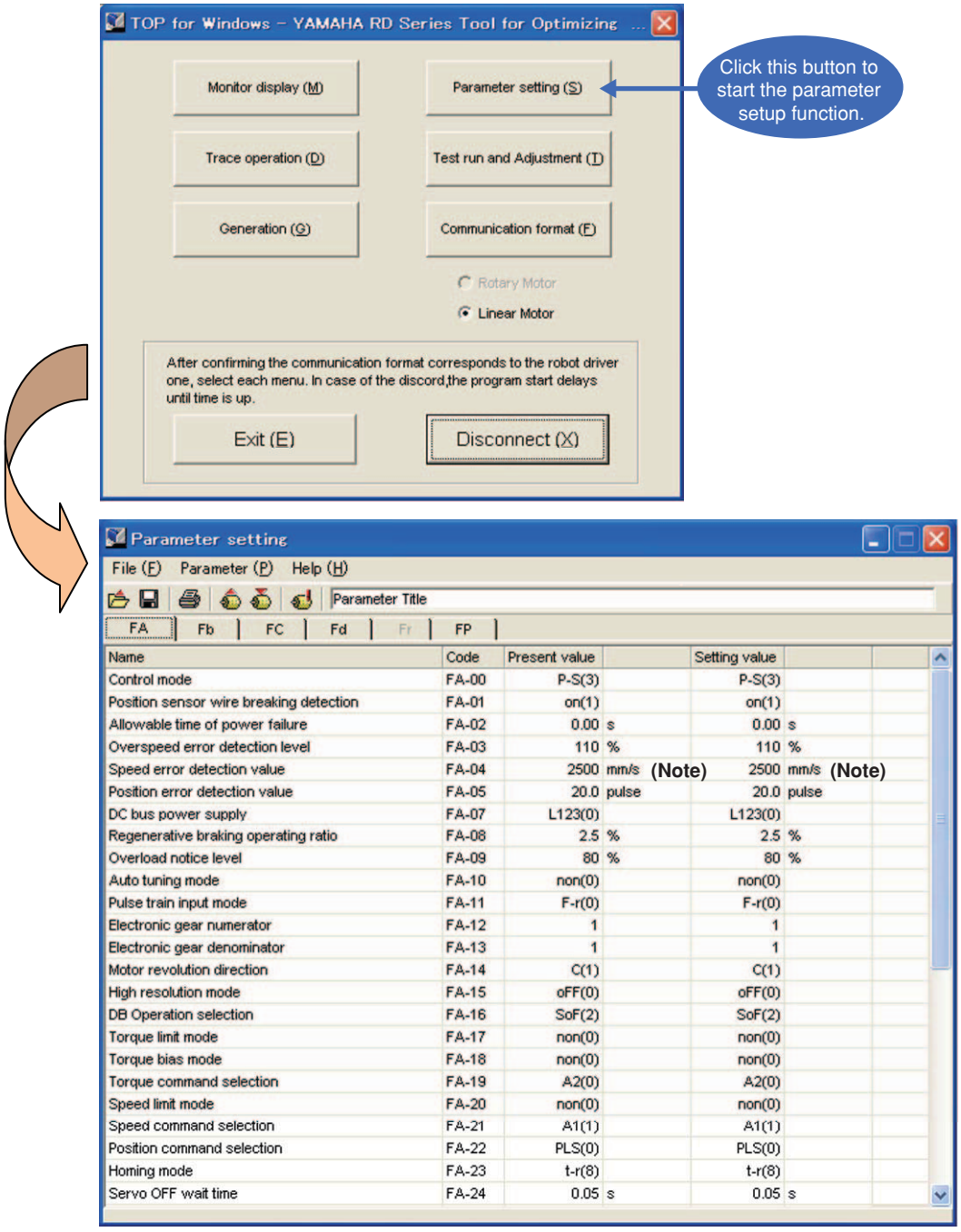
When "Rotary Motor" is selected		When "Linear Motor" is selected	
Item name	**Unit**	**Item name**	**Unit**
Speed command	min^{-1}	Speed command	mm/s
Speed detection value		Speed detection value	
Moment of inertia	$kg \cdot m \times 10^{-4}$	Detected mass on slider	kg × 10
Phase Z position	pulses	Magnetic pole position counter	dig

3.3 Parameter setup function

The parameter setup function allows you to set and control the robot driver parameters.

3.3.1 Starting the parameter setup function

Click the [Parameter setting] button on the opening screen.
The "Parameter setting" window then appears as shown below.

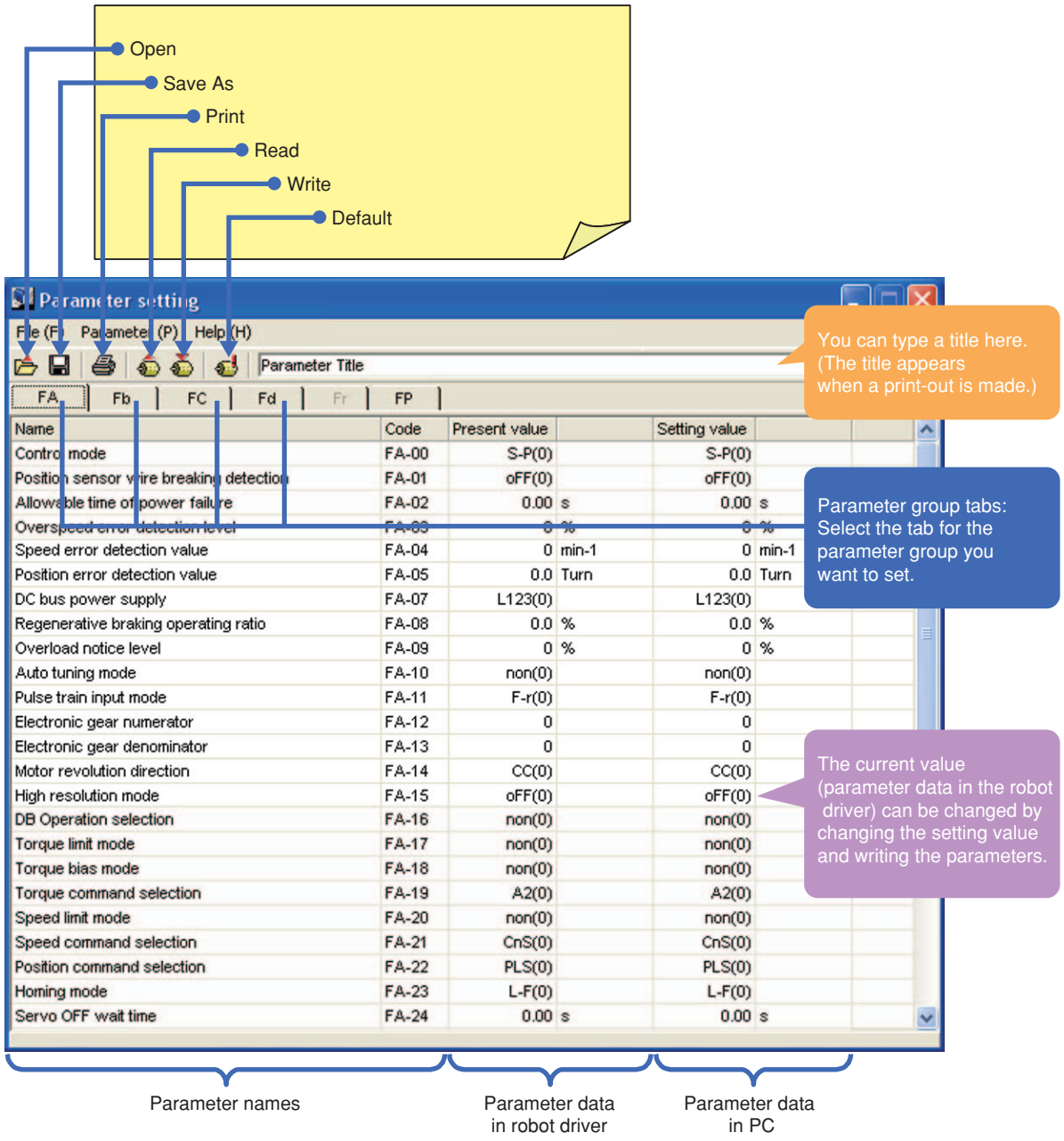

TOP for Windows – YAMAHA RD Series Tool for Optimizing
Monitor display (M)
Parameter setting (S)
Click this button to start the parameter setup function.
Trace operation (D)
Test run and Adjustment (T)
Generation (G)
Communication format (F)
Rotary Motor
Linear Motor
After confirming the communication format corresponds to the robot driver one, select each menu. In case of the discord,the program start delays until time is up.
Exit (E)
Disconnect (X)
Parameter setting
File (F) Parameter (P) Help (H)
Parameter Title
FA Fb FC Fd Fr FP

Name	Code	Present value		Setting value	
Control mode	FA-00	P-S(3)		P-S(3)	
Position sensor wire breaking detection	FA-01	on(1)		on(1)	
Allowable time of power failure	FA-02	0.00	s	0.00	s
Overspeed error detection level	FA-03	110	%	110	%
Speed error detection value	FA-04	2500	mm/s (Note)	2500	mm/s (Note)
Position error detection value	FA-05	20.0	pulse	20.0	pulse
DC bus power supply	FA-07	L123(0)		L123(0)	
Regenerative braking operating ratio	FA-08	2.5	%	2.5	%
Overload notice level	FA-09	80	%	80	%
Auto tuning mode	FA-10	non(0)		non(0)	
Pulse train input mode	FA-11	F-r(0)		F-r(0)	
Electronic gear numerator	FA-12	1		1	
Electronic gear denominator	FA-13	1		1	
Motor revolution direction	FA-14	C(1)		C(1)	
High resolution mode	FA-15	oFF(0)		oFF(0)	
DB Operation selection	FA-16	SoF(2)		SoF(2)	
Torque limit mode	FA-17	non(0)		non(0)	
Torque bias mode	FA-18	non(0)		non(0)	
Torque command selection	FA-19	A2(0)		A2(0)	
Speed limit mode	FA-20	non(0)		non(0)	
Speed command selection	FA-21	A1(1)		A1(1)	
Position command selection	FA-22	PLS(0)		PLS(0)	
Homing mode	FA-23	t-r(8)		t-r(8)	
Servo OFF wait time	FA-24	0.05	s	0.05	s

Note: Parameters and units shown here vary depending on whether "Rotary Motor" or "Linear Motor" was selected. See the robot driver user's manual for detailed parameter information.

3.3.2 Parameter setting window description

The "Parameter setting" window is displayed as shown below.


Open
Save As
Print
Read
Write
Default
Parameter setting
File (F) Parameter (P) Help (H)
Parameter Title
FA Fb FC Fd Fr FP
You can type a title here. (The title appears when a print-out is made.)
Parameter group tabs: Select the tab for the parameter group you want to set.
The current value (parameter data in the robot driver) can be changed by changing the setting value and writing the parameters.
Parameter names
Parameter data in robot driver
Parameter data in PC

Name	Code	Present value		Setting value	
Control mode	FA-00	S-P(0)		S-P(0)	
Position sensor wire breaking detection	FA-01	oFF(0)		oFF(0)	
Allowable time of power failure	FA-02	0.00	s	0.00	s
Overspeed error detection level	FA-03	0	%	0	%
Speed error detection value	FA-04	0	min-1	0	min-1
Position error detection value	FA-05	0.0	Turn	0.0	Turn
DC bus power supply	FA-07	L123(0)		L123(0)	
Regenerative braking operating ratio	FA-08	0.0	%	0.0	%
Overload notice level	FA-09	0	%	0	%
Auto tuning mode	FA-10	non(0)		non(0)	
Pulse train input mode	FA-11	F-r(0)		F-r(0)	
Electronic gear numerator	FA-12	0		0	
Electronic gear denominator	FA-13	0		0	
Motor revolution direction	FA-14	CC(0)		CC(0)	
High resolution mode	FA-15	oFF(0)		oFF(0)	
DB Operation selection	FA-16	non(0)		non(0)	
Torque limit mode	FA-17	non(0)		non(0)	
Torque bias mode	FA-18	non(0)		non(0)	
Torque command selection	FA-19	A2(0)		A2(0)	
Speed limit mode	FA-20	non(0)		non(0)	
Speed command selection	FA-21	CnS(0)		CnS(0)	
Position command selection	FA-22	PLS(0)		PLS(0)	
Homing mode	FA-23	L-F(0)		L-F(0)	
Servo OFF wait time	FA-24	0.00	s	0.00	s

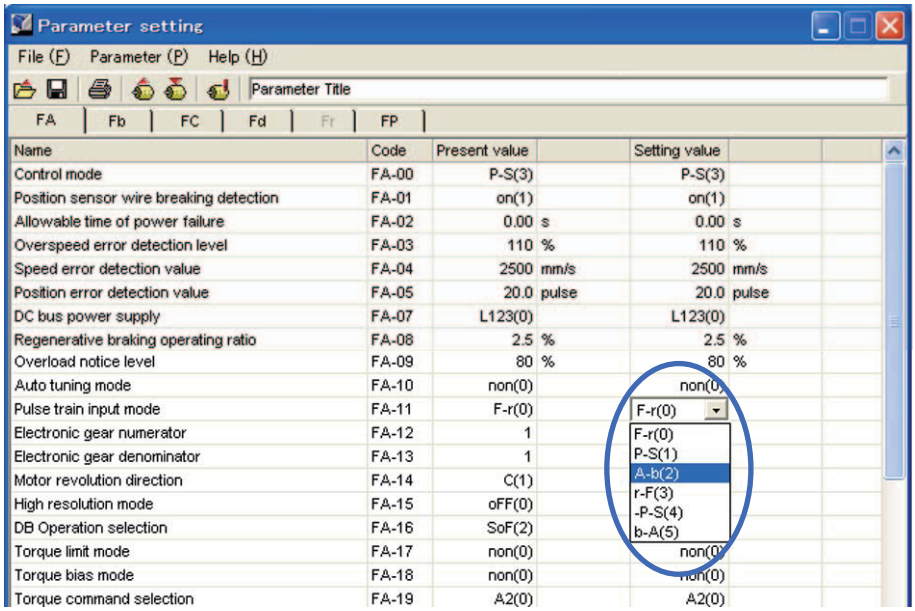
3.3.3 Changing the parameters

This section explains how to change parameters, using the following two examples.

- Select from the drop-down list --- [Example 1] To change the pulse train input mode (FA-11).
- Directly enter a value --- [Example 2] To change the electronic gear denominator (FA-13).

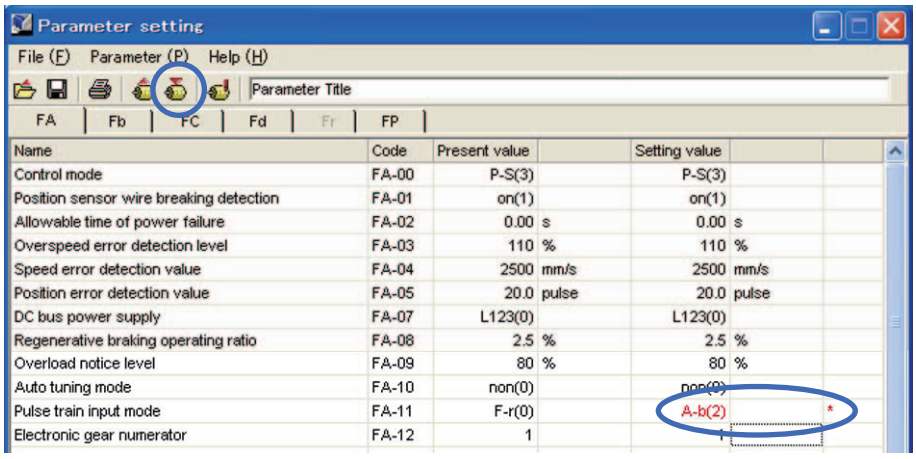
[Example 1] To change the pulse train input mode (FA-11).

1. Select the [FA] tab, click the down arrow button to the right of the "Setting value" field for FA-11, and select a new setting from the drop-down list.


Parameter setting
File (F) Parameter (P) Help (H)
Parameter Title
FA Fb FC Fd Fr FP
Name | Code | Present value | Setting value
Control mode | FA-00 | P-S(3) | P-S(3)
Position sensor wire breaking detection | FA-01 | on(1) | on(1)
Allowable time of power failure | FA-02 | 0.00 s | 0.00 s
Overspeed error detection level | FA-03 | 110 % | 110 %
Speed error detection value | FA-04 | 2500 mm/s | 2500 mm/s
Position error detection value | FA-05 | 20.0 pulse | 20.0 pulse
DC bus power supply | FA-07 | L123(0) | L123(0)
Regenerative braking operating ratio | FA-08 | 2.5 % | 2.5 %
Overload notice level | FA-09 | 80 % | 80 %
Auto tuning mode | FA-10 | non(0) | non(0)
Pulse train input mode | FA-11 | F-r(0) | F-r(0)
Electronic gear numerator | FA-12 | 1 | 1
Electronic gear denominator | FA-13 | 1 | 1
Motor revolution direction | FA-14 | C(1) | C(1)
High resolution mode | FA-15 | oFF(0) | oFF(0)
DB Operation selection | FA-16 | SoF(2) | SoF(2)
Torque limit mode | FA-17 | non(0) | non(0)
Torque bias mode | FA-18 | non(0) | non(0)
Torque command selection | FA-19 | A2(0) | A2(0)
F-r(0)
P-S(1)
A-b(2)
r-F(3)
-P-S(4)
b-A(5)

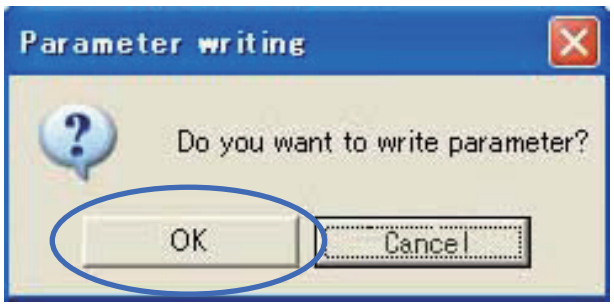
Note: Drop-down list numeric values which appear in parentheses are the internal representation value of the robot driver.

2. Verify that the "Setting Value" changes to red, and that an asterisk displays to its right.

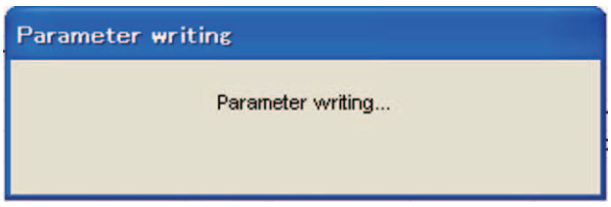

Parameter setting
File (F) Parameter (P) Help (H)
Parameter Title
FA Fb FC Fd Fr FP
Name | Code | Present value | Setting value
Control mode | FA-00 | P-S(3) | P-S(3)
Position sensor wire breaking detection | FA-01 | on(1) | on(1)
Allowable time of power failure | FA-02 | 0.00 s | 0.00 s
Overspeed error detection level | FA-03 | 110 % | 110 %
Speed error detection value | FA-04 | 2500 mm/s | 2500 mm/s
Position error detection value | FA-05 | 20.0 pulse | 20.0 pulse
DC bus power supply | FA-07 | L123(0) | L123(0)
Regenerative braking operating ratio | FA-08 | 2.5 % | 2.5 %
Overload notice level | FA-09 | 80 % | 80 %
Auto tuning mode | FA-10 | non(0) | non(0)
Pulse train input mode | FA-11 | F-r(0) | A-b(2) *
Electronic gear numerator | FA-12 | 1

3. Select "Write" from the "Parameter" menu or click the button on the toolbar.

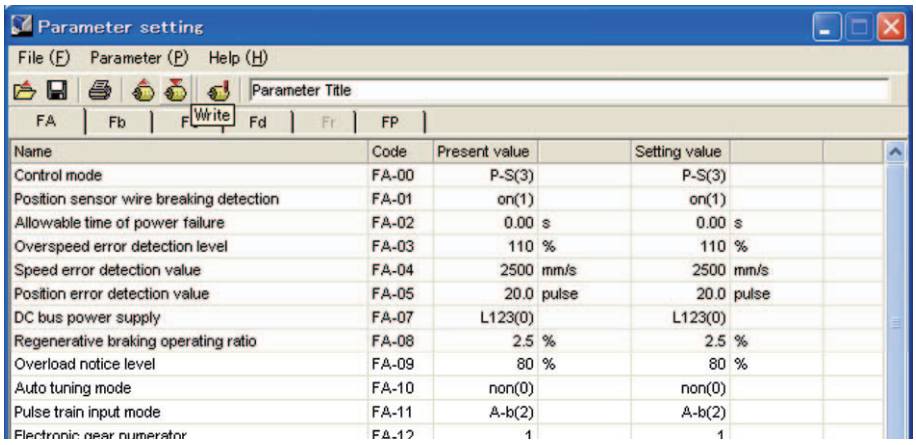
4. The following screen then displays. To proceed with the operation, click the [OK] button.



5. The following message then appears indicating the parameter is being written.



6. When finished rewriting the parameter, the setting shown in red turns black and the asterisk (*) placed on the right side disappears.


Parameter setting
File (F) Parameter (P) Help (H)
Parameter Title
Write
FA Fb Fc Fd Fr FP
Name Code Present value Setting value
Control mode FA-00 P-S(3) P-S(3)
Position sensor wire breaking detection FA-01 on(1) on(1)
Allowable time of power failure FA-02 0.00 s 0.00 s
Overspeed error detection level FA-03 110 % 110 %
Speed error detection value FA-04 2500 mm/s 2500 mm/s
Position error detection value FA-05 20.0 pulse 20.0 pulse
DC bus power supply FA-07 L123(0) L123(0)
Regenerative braking operating ratio FA-08 2.5 % 2.5 %
Overload notice level FA-09 80 % 80 %
Auto tuning mode FA-10 non(0) non(0)
Pulse train input mode FA-11 A-b(2) A-b(2)
Electronic gear numerator FA-12 1 1

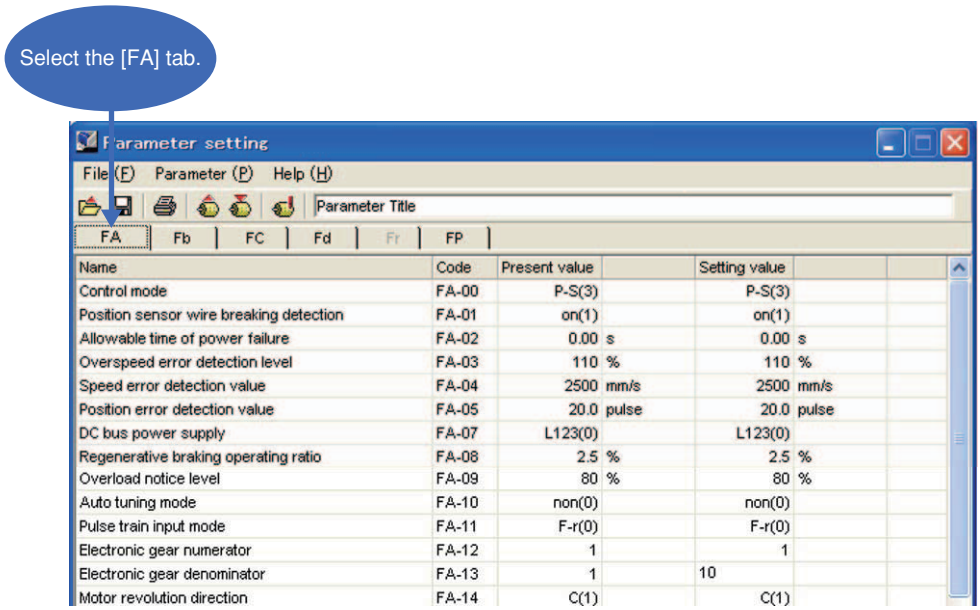
Note 1: An error is displayed on the screen if an attempt is made to rewrite a parameter that is write-prohibited during servo-on.

Note 2: Some parameter settings will not be recognized unless the robot driver's control power is restarted after the writing operation.

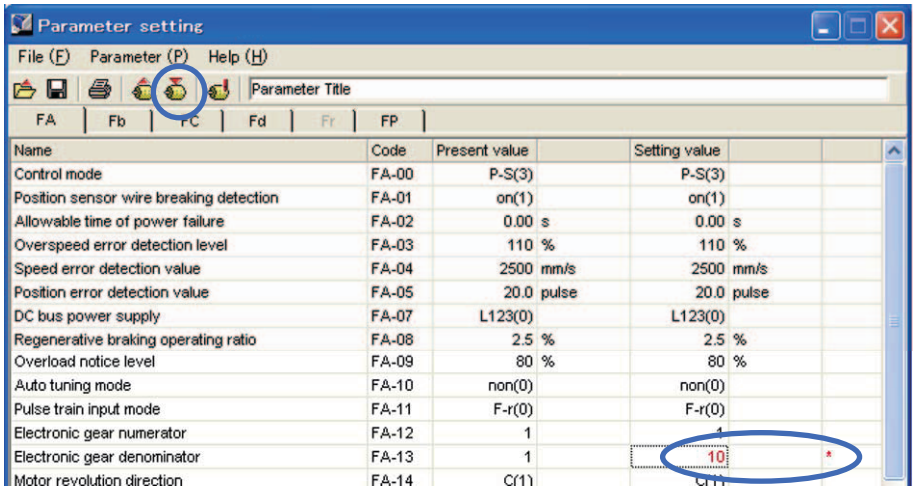
Note 3: Do not turn off the robot driver control power while a parameter is being written. The EEPROM data (stored data) in the robot driver might be destroyed if the control power is turned off during parameter write, causing the robot driver to malfunction.

[Example 2] To change the electronic gear denominator (FA-13).

1. Select the [FA] tab, place the mouse pointer in the "Setting value" field for FA-13, and enter a new setting.

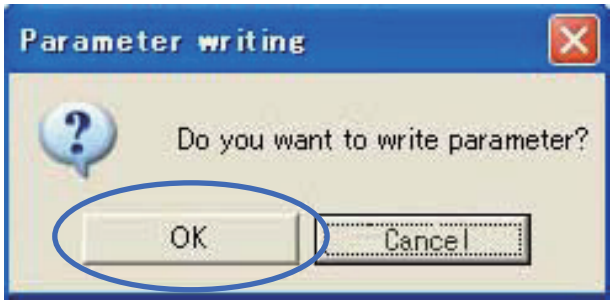

Select the [FA] tab.
Parameter setting
File (F) Parameter (P) Help (H)
Parameter Title
FA Fb FC Fd Fr FP
Name | Code | Present value | Setting value
Control mode | FA-00 | P-S(3) | P-S(3)
Position sensor wire breaking detection | FA-01 | on(1) | on(1)
Allowable time of power failure | FA-02 | 0.00 s | 0.00 s
Overspeed error detection level | FA-03 | 110 % | 110 %
Speed error detection value | FA-04 | 2500 mm/s | 2500 mm/s
Position error detection value | FA-05 | 20.0 pulse | 20.0 pulse
DC bus power supply | FA-07 | L123(0) | L123(0)
Regenerative braking operating ratio | FA-08 | 2.5 % | 2.5 %
Overload notice level | FA-09 | 80 % | 80 %
Auto tuning mode | FA-10 | non(0) | non(0)
Pulse train input mode | FA-11 | F-r(0) | F-r(0)
Electronic gear numerator | FA-12 | 1 | 1
Electronic gear denominator | FA-13 | 1 | 10
Motor revolution direction | FA-14 | C(1) | C(1)

2. Verify that the "Setting Value" changes to red, and that an asterisk displays to its right.

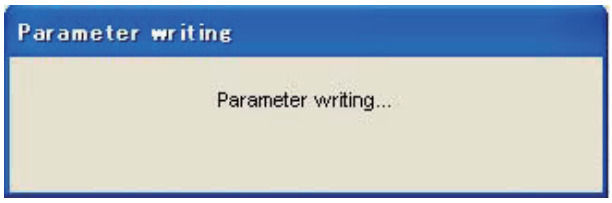

Parameter setting
File (F) Parameter (P) Help (H)
Parameter Title
FA Fb FC Fd Fr FP
Name | Code | Present value | Setting value
Control mode | FA-00 | P-S(3) | P-S(3)
Position sensor wire breaking detection | FA-01 | on(1) | on(1)
Allowable time of power failure | FA-02 | 0.00 s | 0.00 s
Overspeed error detection level | FA-03 | 110 % | 110 %
Speed error detection value | FA-04 | 2500 mm/s | 2500 mm/s
Position error detection value | FA-05 | 20.0 pulse | 20.0 pulse
DC bus power supply | FA-07 | L123(0) | L123(0)
Regenerative braking operating ratio | FA-08 | 2.5 % | 2.5 %
Overload notice level | FA-09 | 80 % | 80 %
Auto tuning mode | FA-10 | non(0) | non(0)
Pulse train input mode | FA-11 | F-r(0) | F-r(0)
Electronic gear numerator | FA-12 | 1 |
Electronic gear denominator | FA-13 | 1 | 10 *
Motor revolution direction | FA-14 | C(1) |

3. Select "Write" from the "Parameter" menu or click the button on the toolbar.

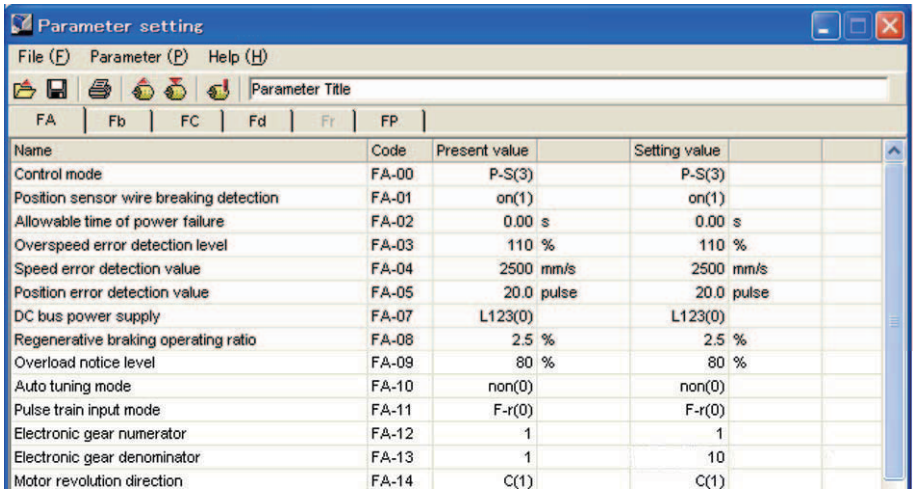
4. The following screen then displays. To proceed with the operation, click the [OK] button.



5. The following message then appears indicating the parameter is being written.



6. When the parameter has been rewritten, the setting shown in red turns black and the asterisk (*) placed on the right side disappears.



Name	Code	Present value		Setting value	
Control mode	FA-00	P-S(3)		P-S(3)	
Position sensor wire breaking detection	FA-01	on(1)		on(1)	
Allowable time of power failure	FA-02	0.00	s	0.00	s
Overspeed error detection level	FA-03	110	%	110	%
Speed error detection value	FA-04	2500	mm/s	2500	mm/s
Position error detection value	FA-05	20.0	pulse	20.0	pulse
DC bus power supply	FA-07	L123(0)		L123(0)	
Regenerative braking operating ratio	FA-08	2.5	%	2.5	%
Overload notice level	FA-09	80	%	80	%
Auto tuning mode	FA-10	non(0)		non(0)	
Pulse train input mode	FA-11	F-r(0)		F-r(0)	
Electronic gear numerator	FA-12	1		1	
Electronic gear denominator	FA-13	1		10	
Motor revolution direction	FA-14	C(1)		C(1)	

Note 1: An error is displayed on the screen if an attempt is made to rewrite a parameter that is write-prohibited during servo-on.

Note 2: An error is displayed on the screen if an attempt is made to write a parameter value outside the allowable range.

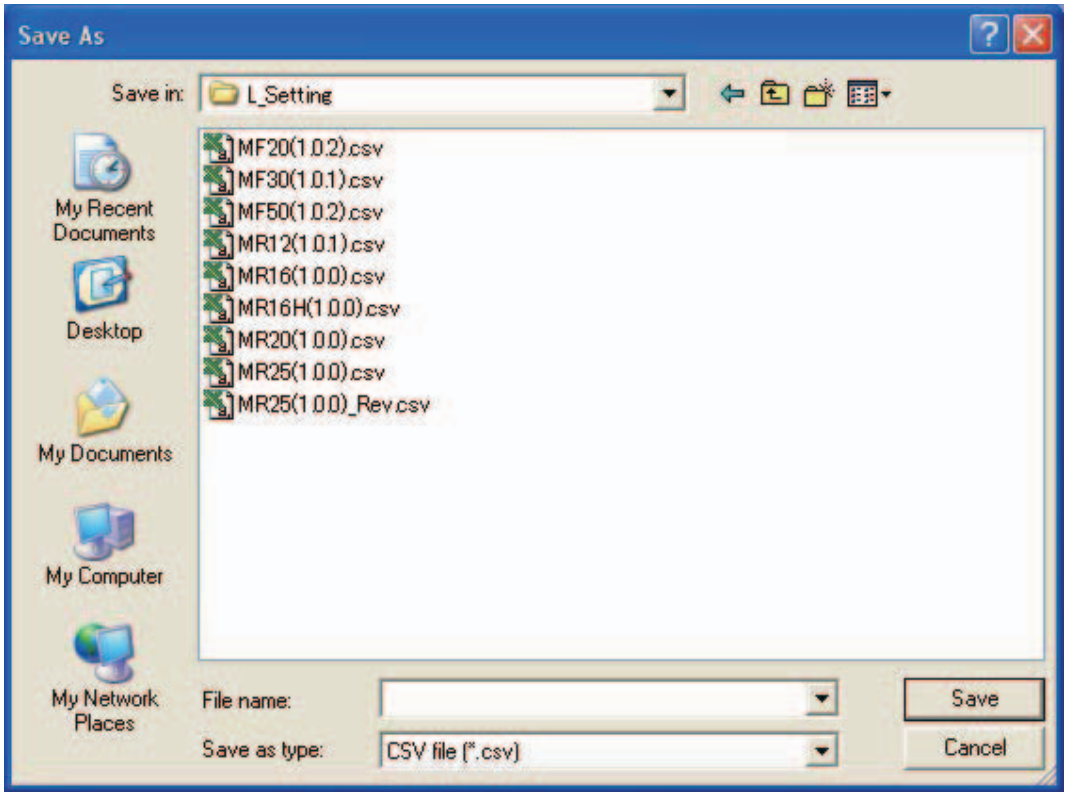
Note 3: Some parameter settings will not be recognized unless the robot driver's control power is restarted after the writing operation.

Note 4: Do not turn off the robot driver control power while a parameter is being written. The EEPROM data (stored data) in the robot driver might be destroyed if the control power is turned off during parameter write, causing the robot driver to malfunction.

3.3.4 Saving the parameters

The parameters can be saved and managed as files.

1. In the "Parameter setting" window, select "Save As" from the "File" menu or click the button on the toolbar.



2. Specify the file save location and the file name, then press the [Save (S)] button to save the data.
   The file can be saved in either of the following two different formats:

   CSV: Saves a file in comma-separated value format.

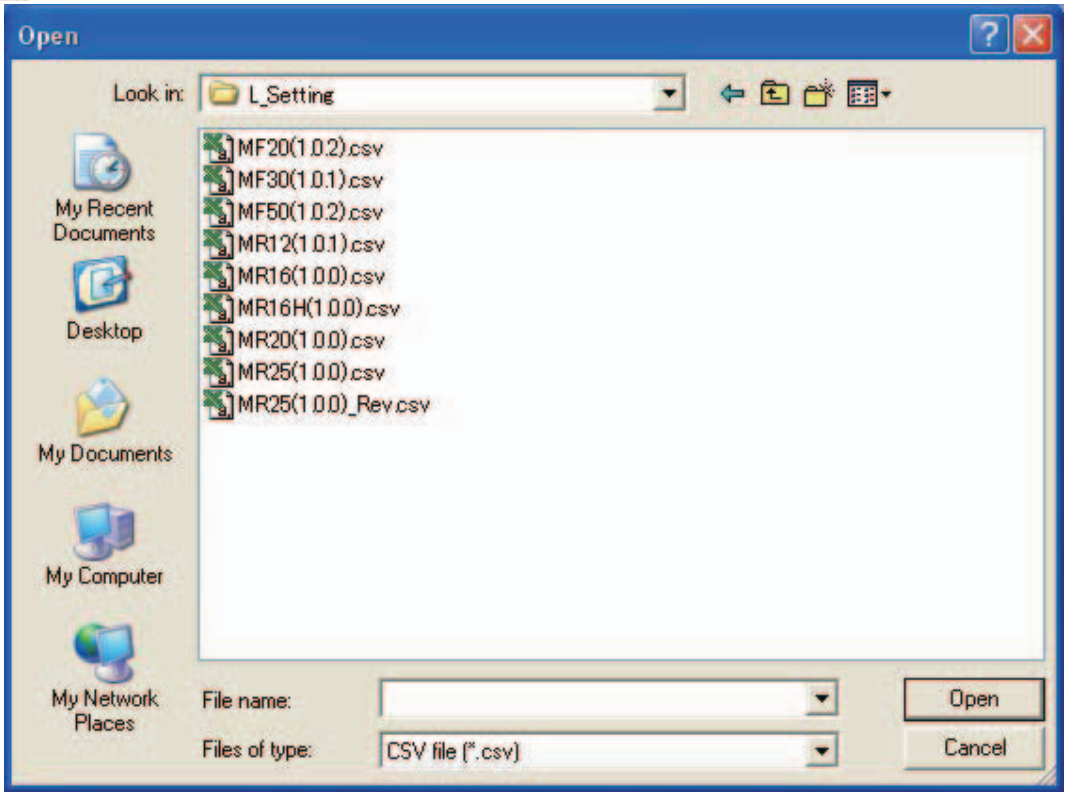
   TXT: Saves a file in tab-separated value format.
   (Files saved in TXT format cannot be read by TOP software.)

Note: Data saved by the above procedure is not robot driver data but PC data (data displayed in "Setting value" column on the "Parameter setting" window). If you save data without completing the write procedure, the saved data differs from the data in the robot driver.

3.3.5 Loading the parameters

Files saved as described in the preceding section can be loaded to set the parameters.

1. In the "Parameter setting" window, select "Open" from the "File" menu or click the button on the toolbar.



2. Specify the location and name of the file to be load, then press the [OPEN (O)] button to load the file.

   Note: Only CSV files can be loaded.

3. After the parameters are loaded from the file, the parameter data appears in red if the PC data does not match the robot driver data.

4. To change the robot driver parameter data, perform a parameter writing operation. For this procedure, see section 3.3.3, "Changing the parameters".

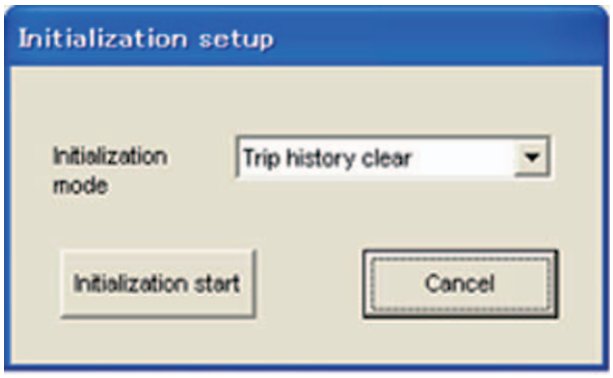
3.3.6 Retuning to the default setting

All parameters can be returned to their default settings (factory settings) and the trip history can be cleared using the pulldown menu or toolbar button.

Note: Initializing the data can not return the robot's default parameters. To return the robot's default parameters, first initialize the data, then perform a generation operation. For this procedure, see section 3.7, "Generation setup".

1. Turn the robot servos OFF and display the Parameter Settings screen.
   From the pull-down menu, select [Parameter (P)] – [Initialization (I)], or press toolbar's (file open) button.

2. When the following dialog box appears, select the initialization mode.
   The following initialization modes are selectable:
   Trip history clear: Clears the alarm history only.
   Data initialization: Clears the parameter data only.



3. Click the [initialization start] button to start the initialization process.
   While initialization is in progress, the robot driver LED indicator shows as follows:
   Trip history clear → HC
   Data initialization → JP

4. When initialization is complete, the robot driver LED indicator shows "d-00".

5. When the "Data initialization" mode has been selected, the PC automatically loads the data from the robot driver after completing initialization.

6. Restart the system (turn power OFF and back ON again).

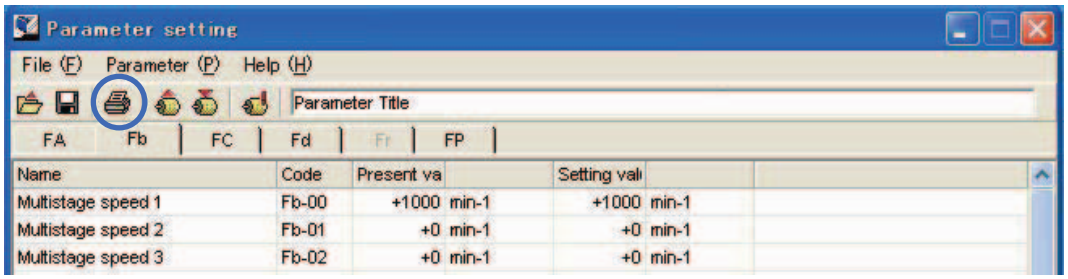
Note 1: Do not turn off the robot driver control power during initialization. The EEPROM data (stored data) in the robot driver might be destroyed if the control power is turned off during initialization, causing the robot driver to malfunction.

Note 2: Before operating the robot after initialization, be sure to execute a generation operation for the model being used. Operating the robot in an initialized condition could result in robot malfunctions, and possible damage.

3.3.7 Printing the parameters

Parameter data can be printed out as a report.

1. In the "Parameter setting" window, select "Print" from the "File" menu or click the button on the toolbar.



2. When the printer setup dialog box appears, enter the items needed to make the printout and print out the data.

3.3.8 Robot driver replacement procedure

This section explains the robot driver replacement procedure.

1. Before beginning this procedure, connect the robot driver to be replaced to the TOP, and save the parameter data. For the save procedure, see section 3.3.4, "Saving the parameters".

2. End TOP operation, then shut off the power.

3. Replace the robot driver.

4. Turn the new robot driver power ON, and connect it to TOP.

5. Perform a generation operation. For this procedure, see section 3.7, "Generation setup".

6. When generation is completed, load the parameter data that was saved at step 1 above. For this procedure, see section 3.3.5, "Loading the parameters".

7. Verify that parameter setting values to be changed display in red at the "Setting Value" column, then write the parameter data from the personal computer to the robot driver. For this procedure, see section 3.3.3, "Changing the parameters".

Note 1: Be sure to replace the robot driver with a driver type that is compatible with the robot. If the driver is incompatible with the robot, the generation operation will not occur properly.

Note 2: When performing the generation operation, be sure to select the model to be used. Performing generation at the wrong model could result in robot malfunctions, and possible damage.

3.4 Operation trace function

This function allows you to visually check the robot and robot driver operation. The table below shows traceable items and control states.

Trace items

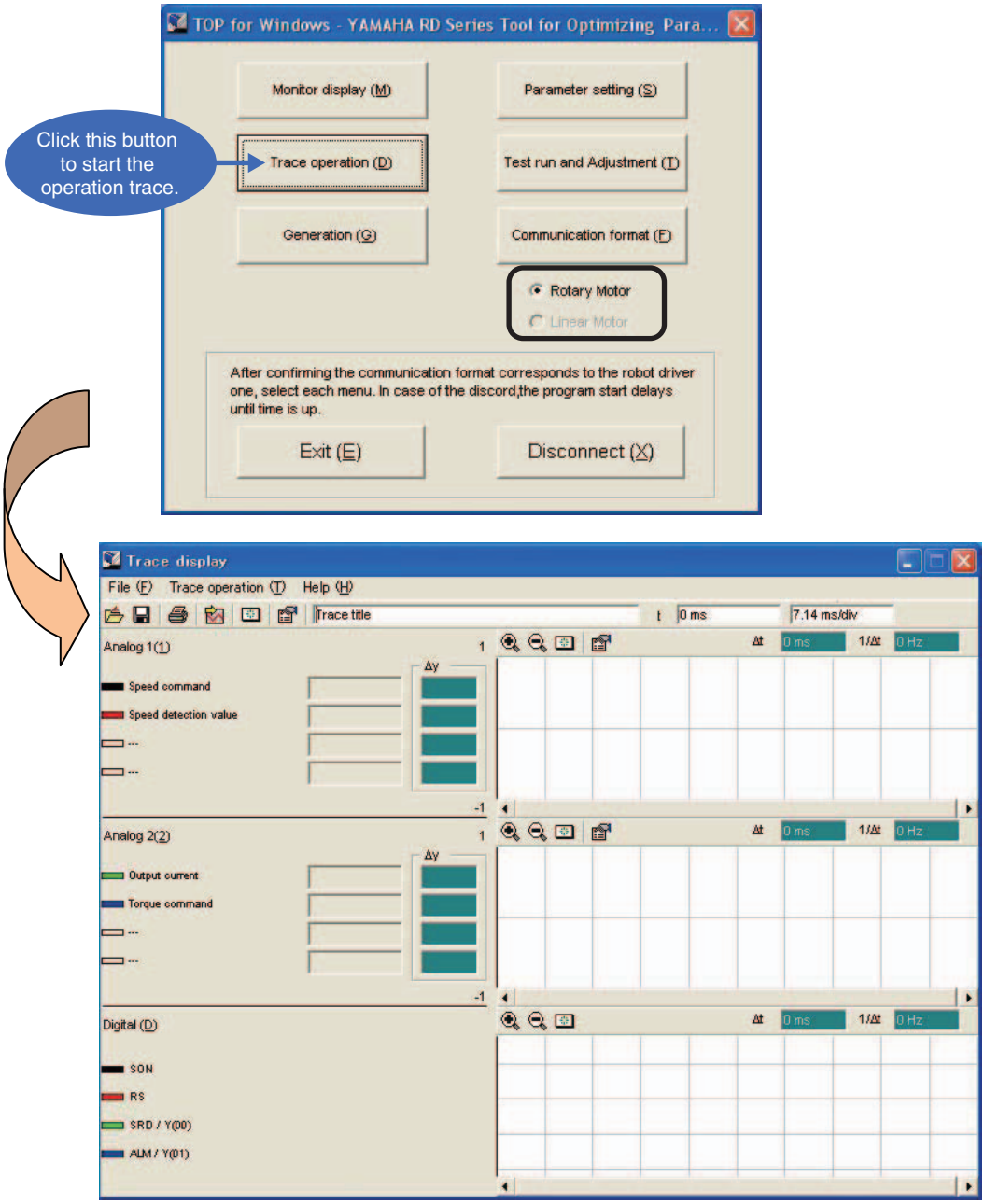
Trace type	Resolution (number of points)		Trace item (units)	Description	Data update intervals
	Time axis	Vertical axis			
Analog graph 1/graph 2	512	65535	Speed command (min^{-1}) (mm/s) (Note 1)	Traces the speed command from the position controller or analog input, etc.	140 µs
			Speed detection value (min^{-1}) (mm/s) (Note 1)	Constantly traces the detected speed value.	140 µs
			Output current (%)	Traces the current pulse height supplied from the robot driver to the robot.	4 ms
			Torque command (%)	Traces the torque current command from the speed controller or analog input, etc.	140 µs
			Output torque (%)	Traces the torque current value.	140 µs
			Position command high order (pulses) (Note 2)	Traces the high-order portion of the position controller's position command.	140 µs
			Position command low order (pulses) (Note 2)	Traces the low-order portion of the position controller's position command.	140 µs
			Current position high order (Note 2)	Traces the high-order portion of the current position.	140 µs
			Current position low order (pulses) (Note 2)	Traces the low-order portion of the current position.	140 µs
			Position error high order (pulses) (Note2)	Traces the high-order portion of the position controller's position error.	140 µs
			Position error low order (pulses) (Note 2)	Traces the low-order portion of the position controller's position error. (32768 dig = 1 rotation)	140 µs
			Output voltage (V)	Traces the RMS voltage supplied from the robot driver to the robot.	40 ms
Digital		2 points	All input terminals	Traces all input terminals.	Approx. 1 ms
			All output terminals	Traces all output terminals.	Approx. 1 ms

Note 1: Units displayed when linear motor type is selected.

Note 2: The angle or distance per pulse differs depending on the encoder type when "rotary motor" is selected or on the linear sensor resolution when in "linear motor" type. Refer to the robot driver user's manual for more details

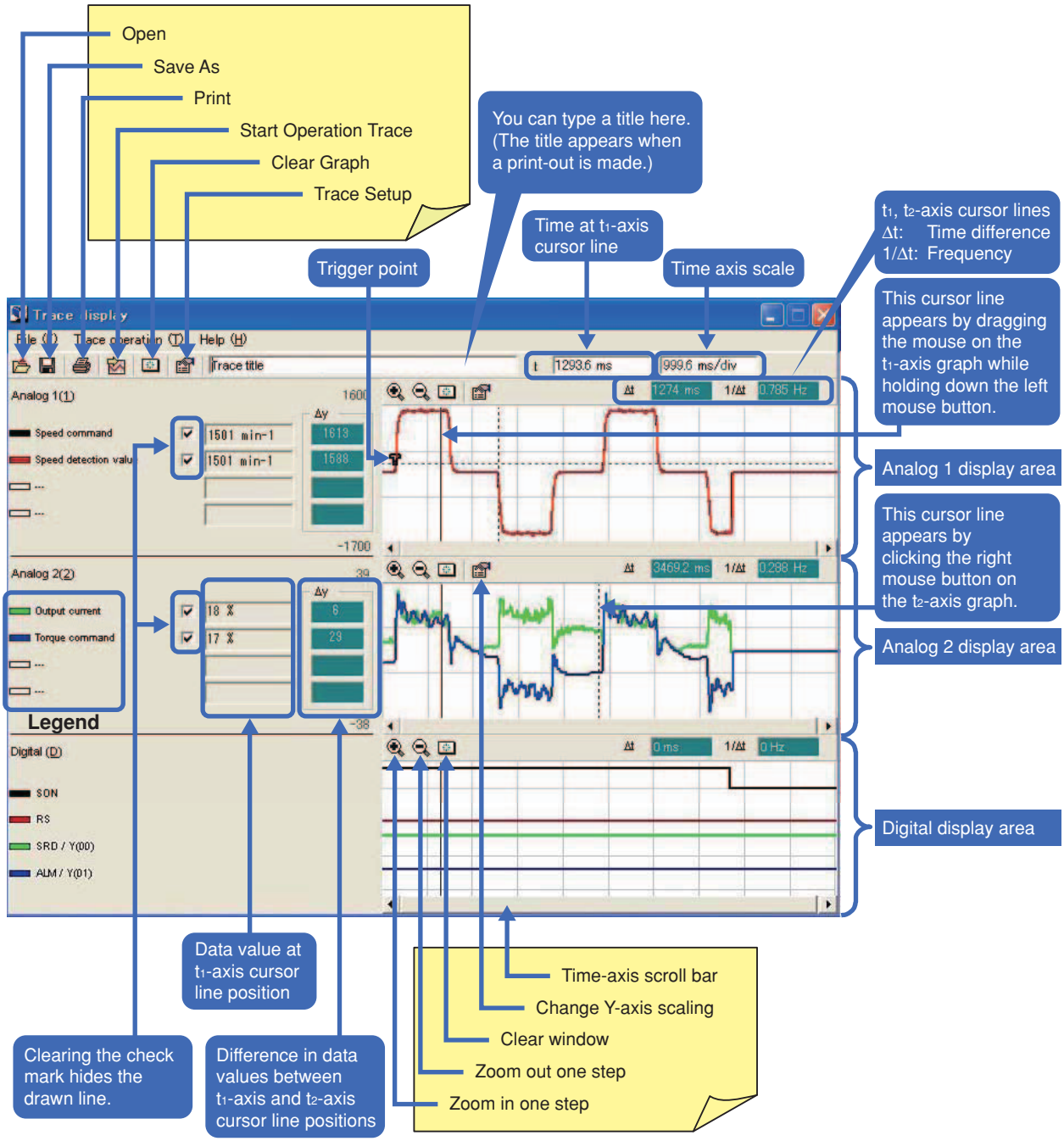
3.4.1 Starting the operation trace function

The "Trace display" window opens when you click the [Trace operation] button on the opening screen.



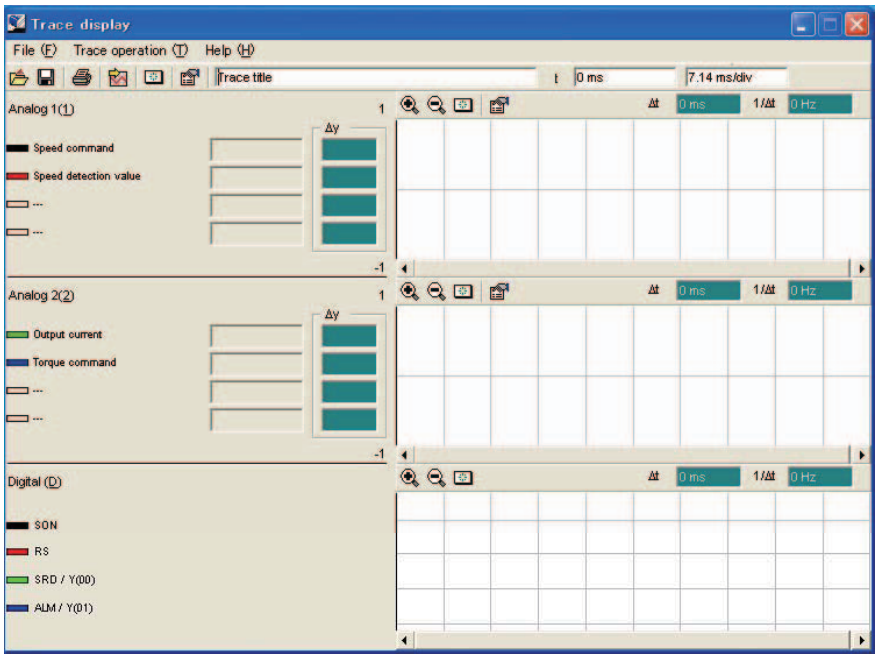
3.4.2 Trace display window description

The "Trace display" window is described below.

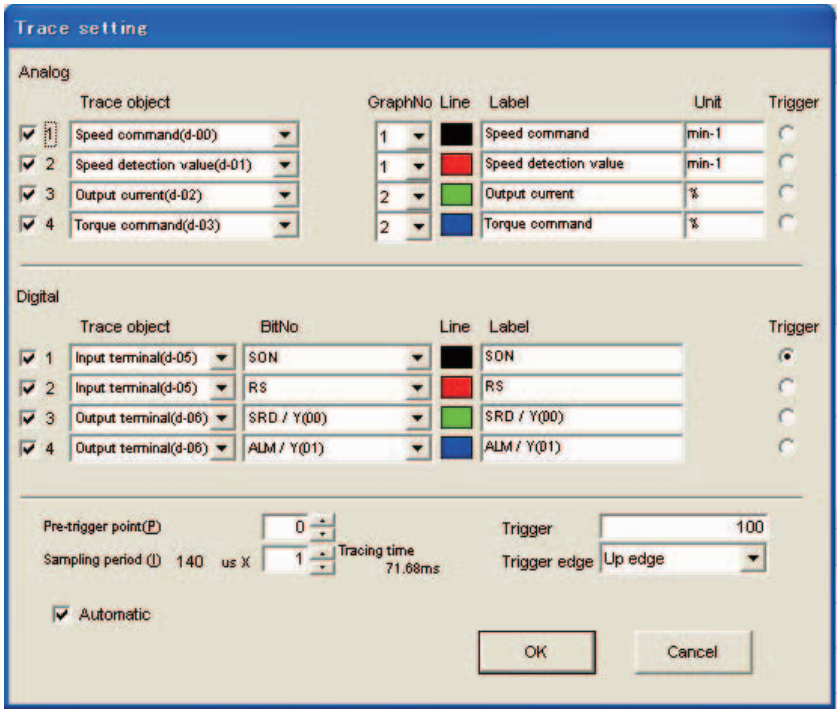


3.4.3 Operation trace sequence

1. Open the "Trace display" window.

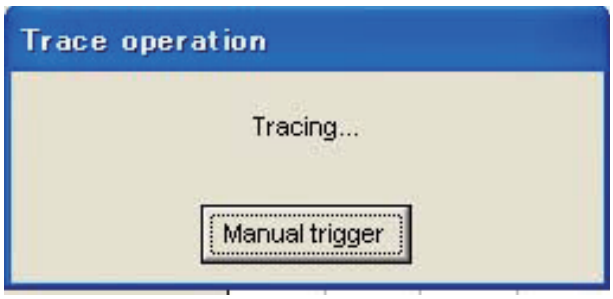


2. Set the trace conditions. (For the setup procedure, see 3.4.4, "Setting the operation trace conditions".)
   Select "Trace setting" from the "Trace operation" menu or click on the toolbar.

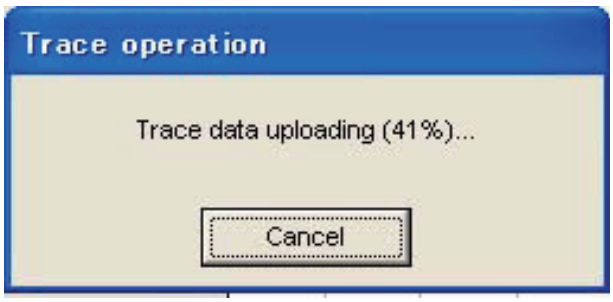


3. After setting the conditions, click the [OK] button.

4. Start operation trace.
   Select "Trace Start" from the "Trace operation" menu or click on the toolbar.
   The following message appears when operation trace has started.



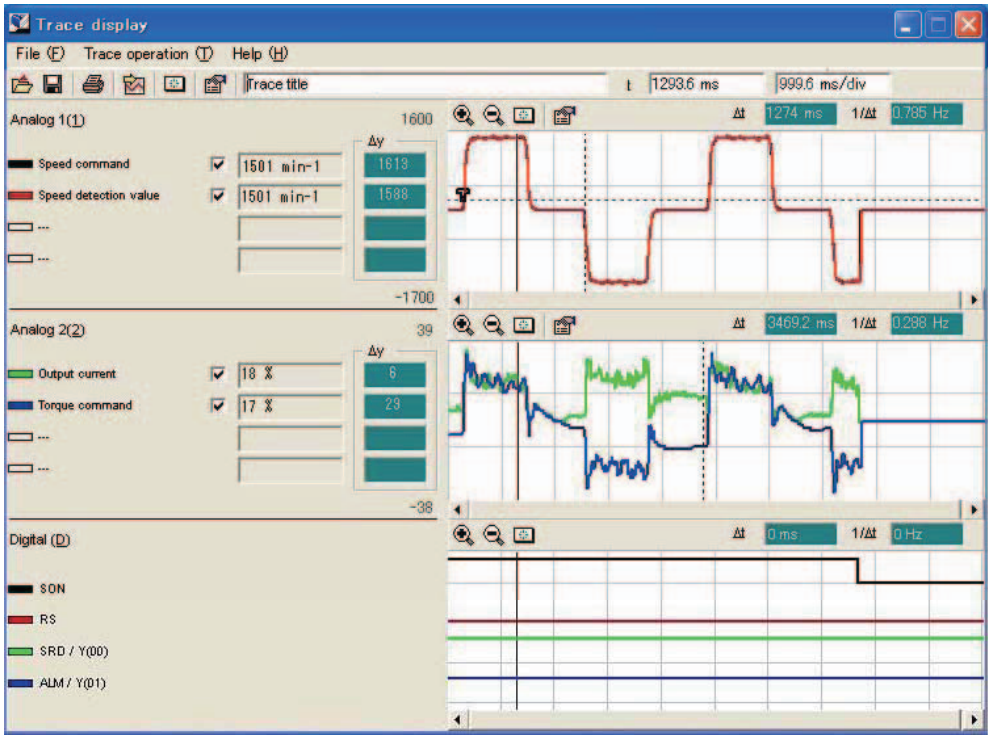
5. When the trigger conditions are met or when you click the [Manual trigger] button in the above message box, the robot driver transfers data to the PC and the following dialog box appears.



Note 1: It might be difficult to view the message "Trace operation was stopped!" if the sampling cycle is short.

Note 2: No graph is drawn if you click the [Cancel] button in the "Trace data uploading ...." message box.

6. When the data transfer is complete, the data is displayed as shown below.

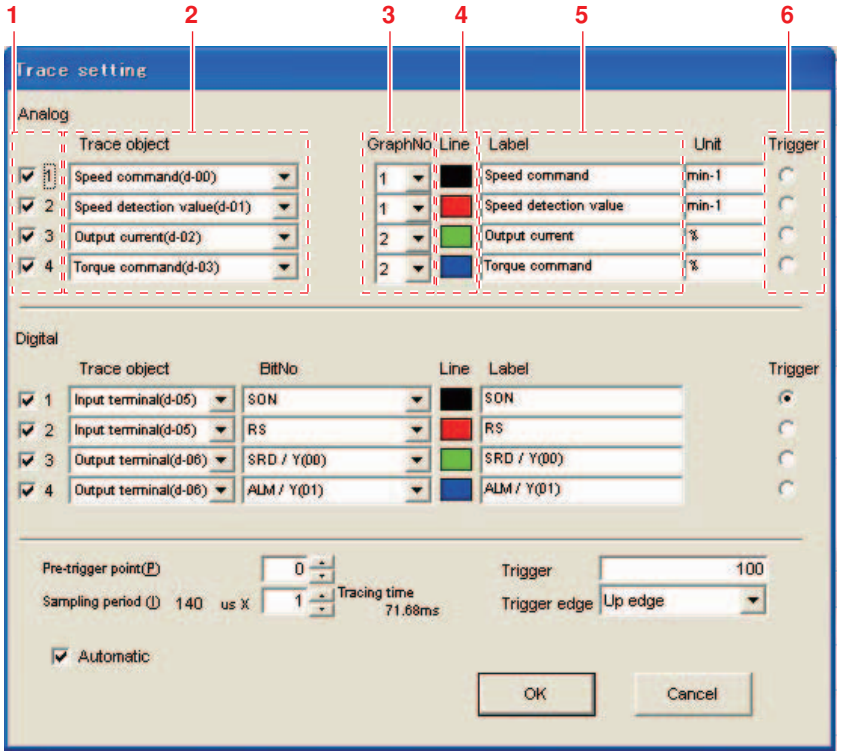


3.4.4 Setting the operation trace conditions

To set the operation trace conditions, open the "Trace setting" window as explained below.
Select "Trace setting" from the "Trace operation" menu or click on the toolbar.
After setting the trace conditions by referring to the procedures below, click the [OK] button to close the "Trace setting" window.

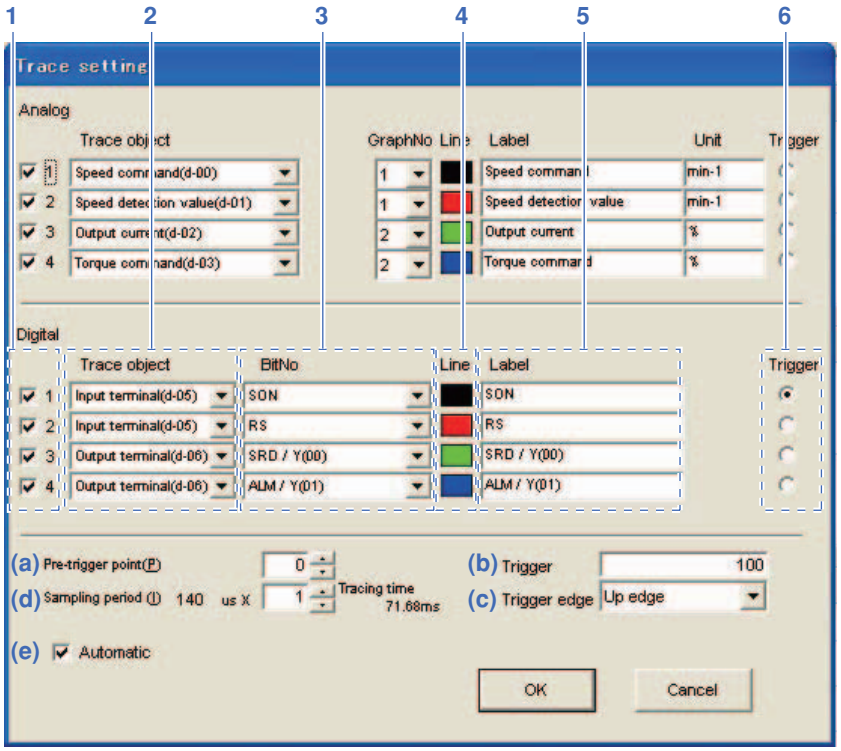
(1)To set the analog trace conditions:

1. Select the check boxes for channels you want to enable.
   Up to 4 channels of analog data can be traced.
2. Select the trace item from the "Trace object" drop-down list.
   For details on the trace items, see the trace item table shown in 3.4, "Operation trace function".
3. Select the display graph No. (1 or 2).
   (No.1 is displayed in analog 1 display area, while No.2 is displayed in analog 2 display area.)
4. Set the display color as desired.
5. Change the label name as needed by entering it directly into the field.
6. Select the channel for triggering.



(2)To set the digital trace conditions:

1. Select the check boxes for the channels you want to enable.
   Up to 4 channels of digital contacts can be traced.
2. Select the trace item from the "Trace object" drop-down list.
   (All input/output terminal data is selectable as trace items. For details on the trace items, see the trace item table shown in 3.4, "Operation trace function".)
3. From the drop-down list, select the name of the terminal to be traced.
   (All input/output terminal data is selectable as trace items. For details on trace items, see the trace item table shown in 3.4, "Operation trace function".)
4. Set the display color as desired.
5. Change the label name as needed by directly entering it in the field.
6. Select the channel for triggering.



(3)Other settings

(a) Pre-trigger point: Displays data starting from a position prior to the trigger point. Set that position here in the number of trace points.

(b) Trigger: Enter the trigger level. (This is valid only for analog trace.)

(c) Trigger edge: Set the trigger edge.

(d) Sampling period: Specify the sampling period or interval. Data will be sampled and displayed at the interval specified here. The maximum tracing time (time during which data can be traced) is displayed to the right of the sampling interval setting.

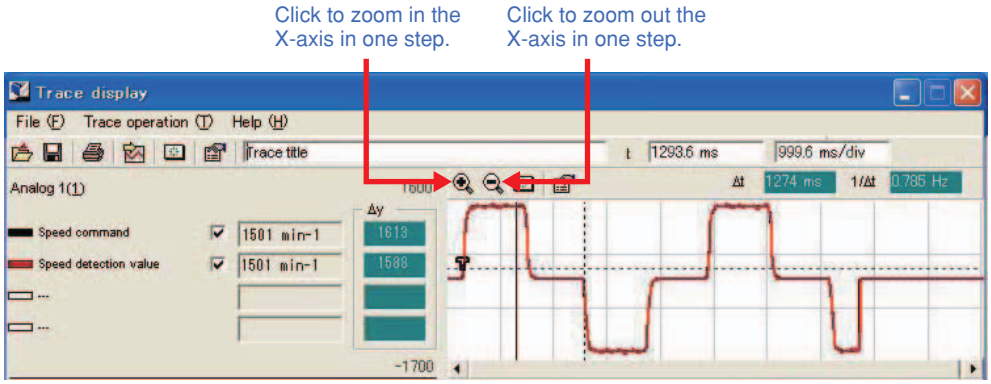
(e) Automatic: Select this check box when you want to optimize the Y-axis scale according to the sampled data.

When all settings are complete, click [OK] to close the window.

3.4.5 Setting the graph display

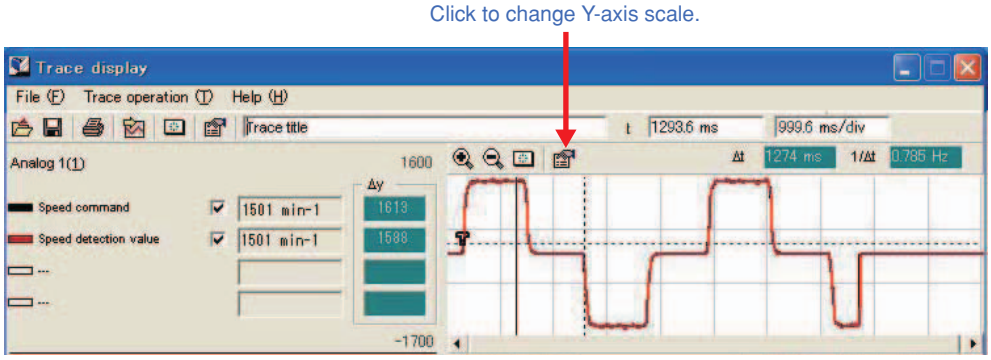
(1) Setting the X-axis direction

The toolbar buttons above each graph allow you to extend the graph in the X-axis direction or return it to standard size. Use the following toolbar buttons.

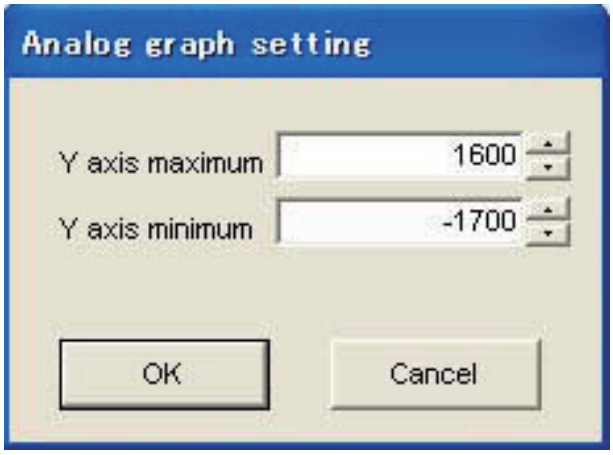


(2) Setting the Y-axis direction

The toolbar button above each graph allows you to change the Y-axis scale. Use the following toolbar button.

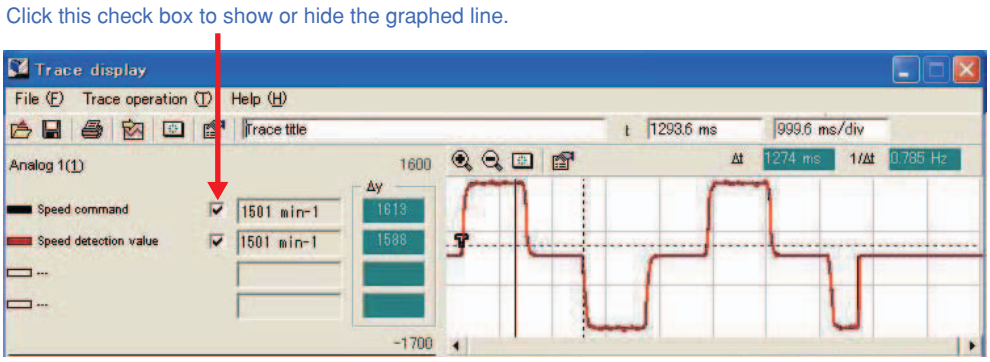


The following window then opens. Enter the maximum and minimum scales and then click the [OK] button. The graph will be redrawn to match the specified scales.



(3)Hiding a graphed line

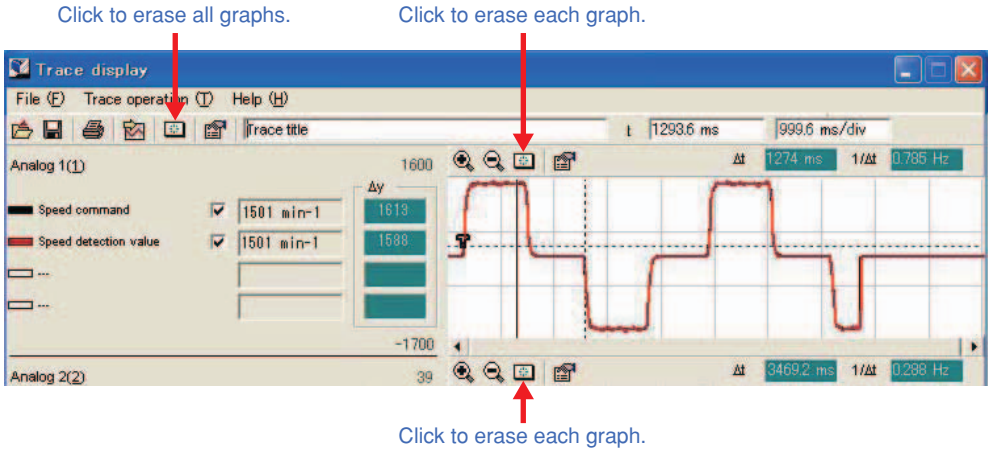
You can hide a graphed line by clearing the check box as described below. To redisplay the graphed line, reselect the check box by placing a check mark.



(4)Clearing the graphs in the window

To erase the graphs displayed in the window, select "Clear display" from the "Trace operation" menu or click on the toolbar.

You can use the following toolbar buttons to erase all graphs or each graph displayed in the window.



3.5 Test run and adjustment functions

This section describes the functions useful for a test run.

3.5.1 Jog

Jog can be run from a PC.

<Jog operation>

Jog operation allows you to make wiring checks for the robot driver, robot and power supply. (No outside connections to the I/O connector are needed for jog operation.)

(1)Jog operation types

There are two types of jog operation: one is normal jog performed in speed control mode, and the other is pulse train jog that feeds according to the number of pulses set in position control mode. Each of these is explained below.

(1)-A Normal jog operation

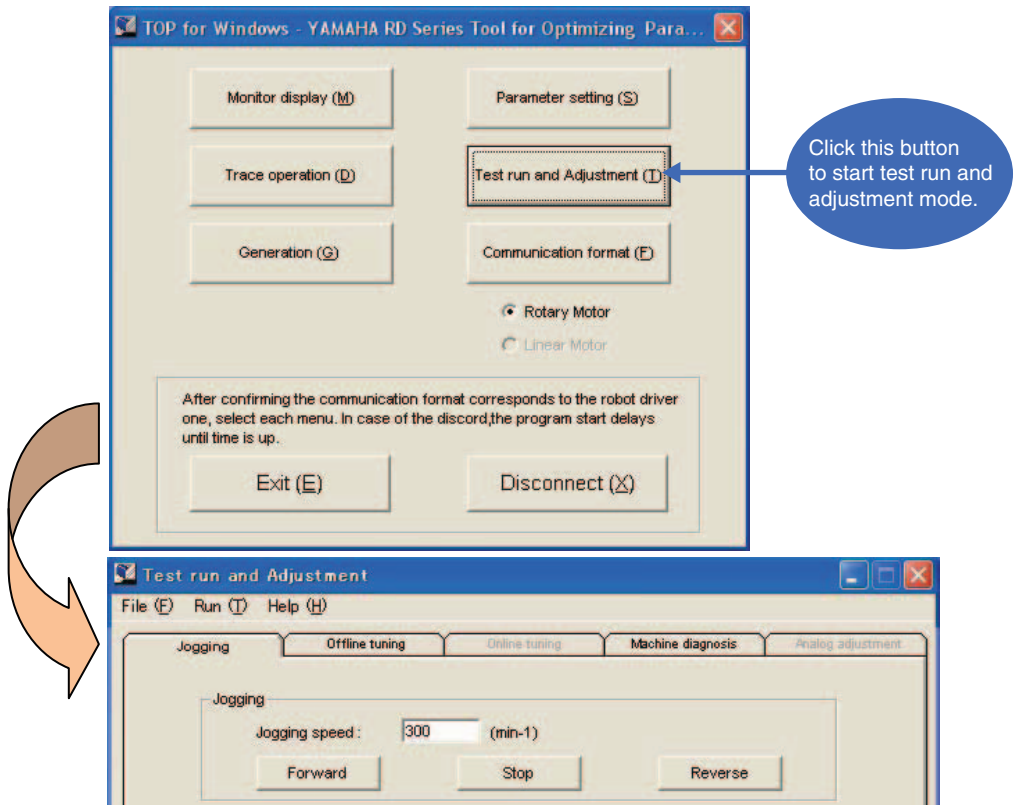
The robot moves at a constant speed specified by the speed command until a stop command is received.

Note 1:Do not input any signals through the I/O connector including the SON terminal during this operation. Doing so runs the operation according to the input terminal.

Note 2:In this jog operation, the robot moves at an acceleration/deceleration time of 0 seconds and the current control gain and speed limit settings.

To run normal jog:

1. Click the [Test run and Adjustment] button on the opening screen.
   The "Test run and Adjustment" window appears as shown below.
   Click the [Jogging] tab.



Note: If the "Monitor display" window is open, close it before starting the test run and adjustment mode.

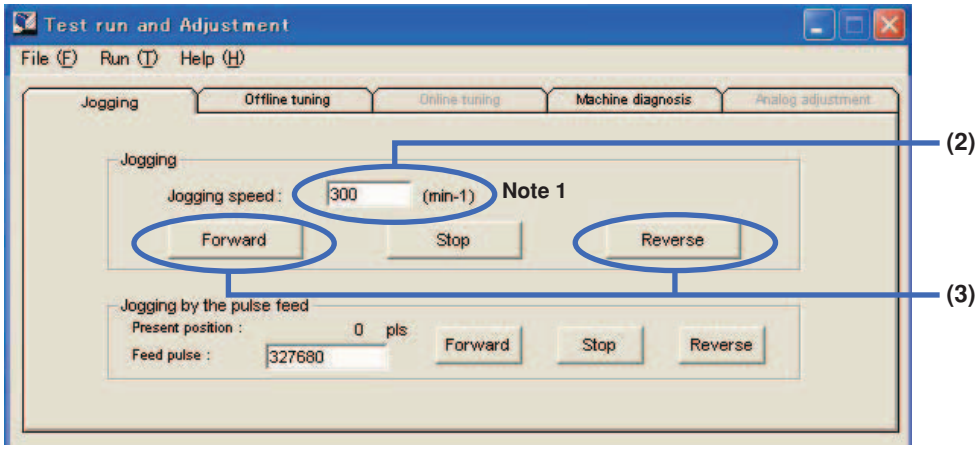
2. Enter the speed command in the "Jogging speed" box (2).

   Note: When "Linear Motor" is selected, the units are "mm/s".

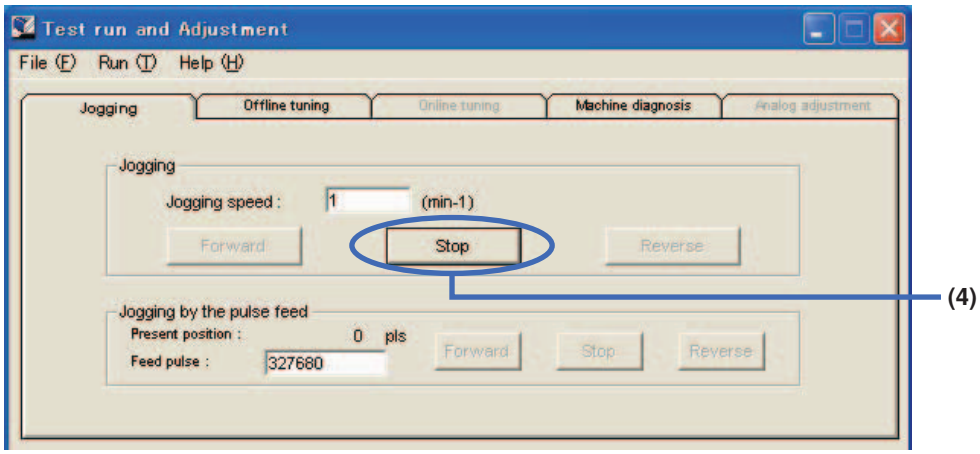
3. Check safety and then click the [Forward] or [Reverse] button (3) that indicates the direction to move the robot.
   (The robot will start moving in the specified direction.)

   Note1: The robot moves during this operation, so check safety before starting operation.

   Note2: When a PHASER series robot is used, magnetic pole position finding must be performed before this operation. For information on magnetic pole position finding, refer to the separate "YAMAHA Single-Axis Robot Driver RD Series" user's manual.



4. To stop operation (turn off the servo), click the [Stop] button (4).



(1)-B Pulse feed jog operation

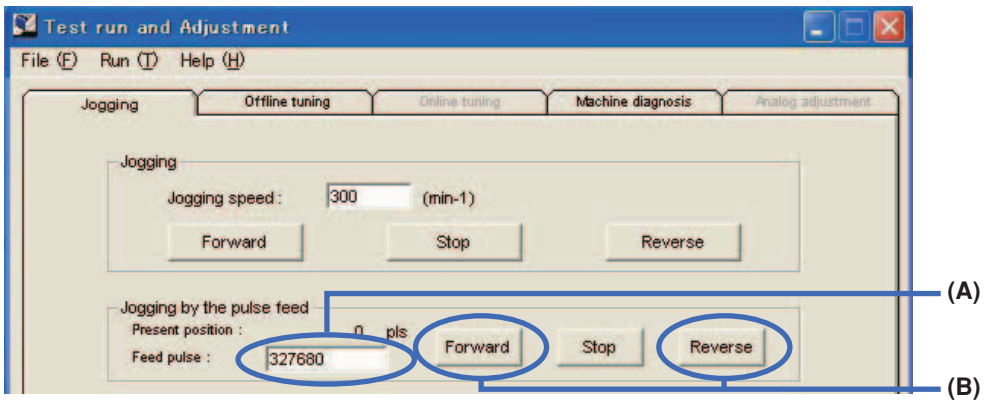
In this jog operation, the robot moves in position control mode up to the position specified by the position command.

Note 1: Do not input any signals through the I/O connector including the SON terminal during this operation. Doing so runs the operation according to the input terminal.

Note 2: In this jog operation, the robot moves at an acceleration/deceleration time of 0 seconds and the current control gain and speed limit settings.

To run pulse feed jog:

1. In the "Rest run and Adjustment" window, enter the number of feed pulses in the "Feed pulse" box (A).



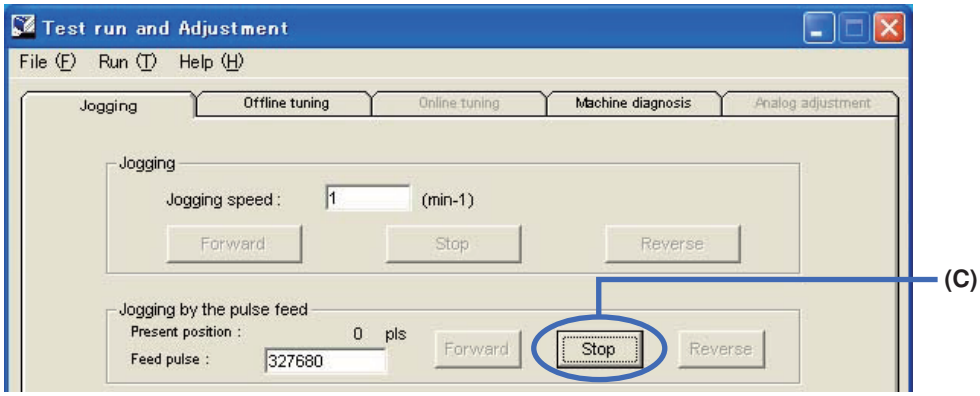
2. Set the speed limit values (Fb-20, Fb-21) to 300 min^{-1} or less.
   Also set the position error detection value (FA-05) to more than the number of feed pulses. (This is to prevent an alarm or out-of-control condition that might occur during jog operation.)

3. Check safety and then click the [Forward] or [Reverse] button (B).
   (The robot will start moving in the specified direction and stop at the position specified by the command.)

   Note1: The robot moves during this operation, so check safety before starting operation.

   Note2: When a PHASER series robot is used, magnetic pole position finding must be performed before this operation. For information on magnetic pole position finding, refer to the separate "YAMAHA Single-Axis Robot Driver RD Series" user's manual.

   The buttons (except [Stop] button) in the "Rest run and Adjustment" window are grayed out during positioning as shown below.



   To stop positioning (turn off the servo), click the [Stop] button (C).

4. After positioning is complete, the "Test and Adjustment" window returns to the state in step 1. The servo is still turned on at this point so click the [Stop] button (C).

3.5.2 Offline tuning

The total inertia including motor inertia can be approximately calculated in offline mode. Use the following procedures to run offline tuning.

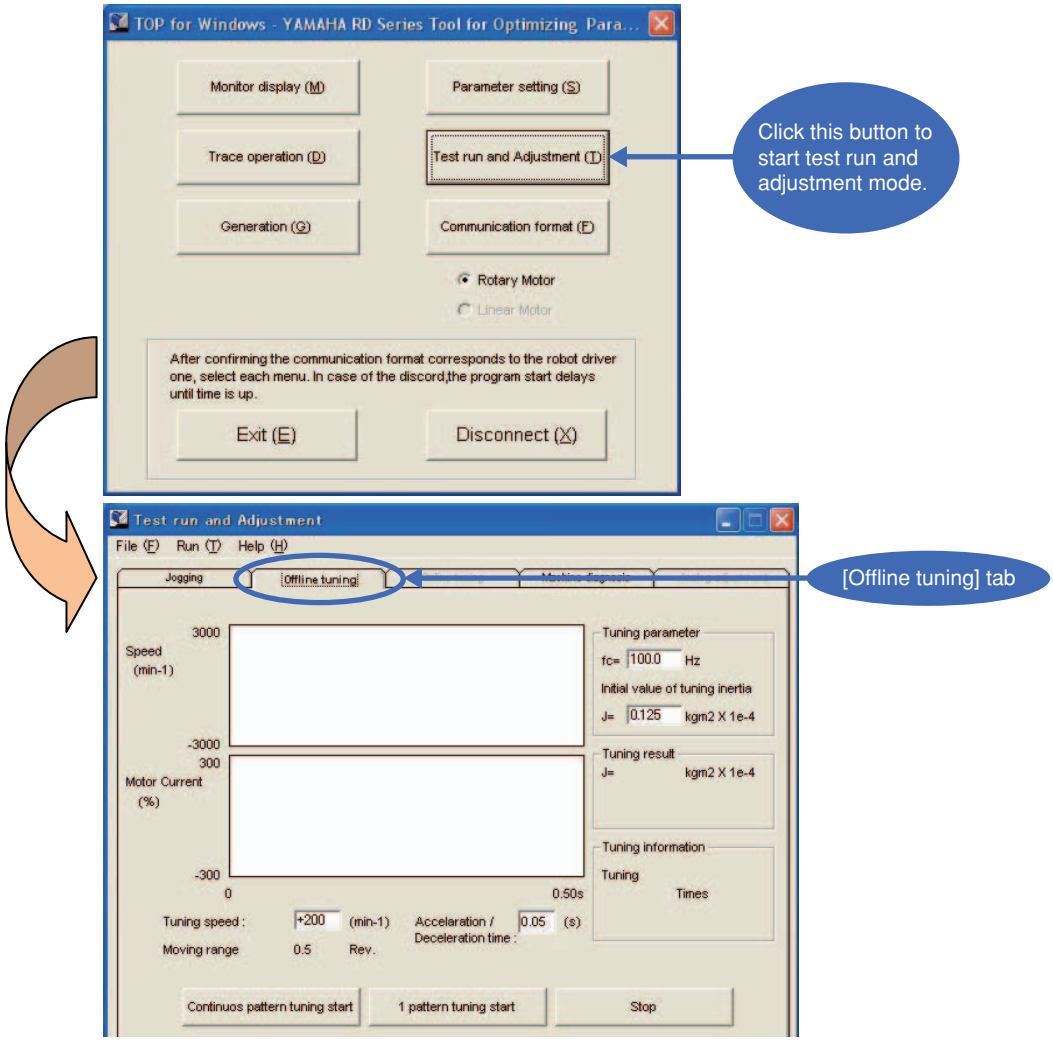
Note 1: The robot driver parameters are factory set to ensure that the robot operates normally. Use of this function is not required except in cases where robot follow-up response is poor, where operation is abnormal, or when adjusting the parameter data.

Note 2: When this function is executed, the moment of inertia (weight of moving part) Fd-00 value is automatically changed. Therefore, be sure to save the parameter data before performing this function. For the data save procedure, see section 3.3.4, "Saving the parameters".

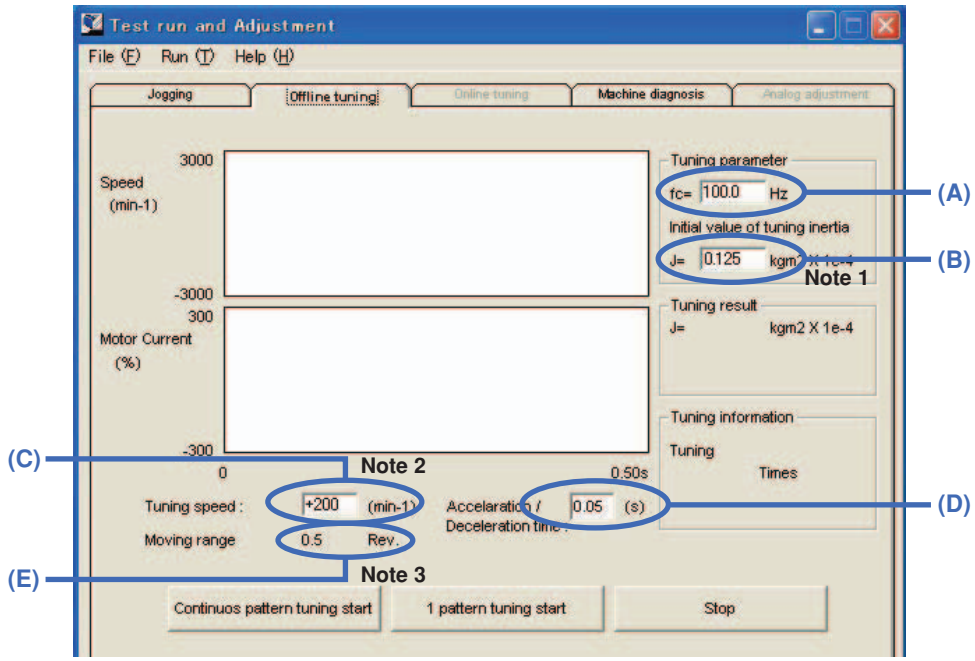
Note 3: When a PHASER series robot is used, the correct inertia value cannot be estimated unless the magnetic pole position is determined. For instructions on how to determine the magnetic pole position, refer to section 5.4, "Return-to-origin function", in the separate "YAMAHA Single-Axis Robot Driver RD Series" user's manual.

(1) Procedure for fully automatic offline tuning

1. Click the [Test run and Adjustment] button on the opening screen.
   The "Test run and Adjustment" window appears as shown below.
   Click the [Offline tuning] tab.



2. Set the following parameters that are required for tuning.



(A) Cut-off frequency (fc) setting

Set the cut-off frequency for controlling the speed during auto-tuning. Set a value that will not cause hunting.

(B) Initial value of tuning moment of inertia

Set the moment of inertia at start of auto-tuning. Tuning will end quickly if setting this to a value that you know will roughly match the moment of inertia. If you do not know this value then leave the setting as is. The auto-tuning function will estimate the moment of inertia.

Note 1:When "Linear Motor" is selected, the edit box label is "=m" and the units are "kg×10".

(C) Tuning speed

Enter the speed to use for auto-tuning. If you are sure that the default value does not damage the system including the robot, you can use the default setting.

Note 2:When "Linear Motor" is selected, the edit box label is "Tuning speed" and the units are "mm/s".

(D) Acceleration/deceleration time

Set an acceleration/deceleration time for pattern operation during auto-tuning. If you are sure that the default value does not damage the system including the robot, you can use the default setting.

(E) Moving range

Displays a general guide for the rotation (distance) amount during auto-tuning. Use the displayed value only for a general guide. Perform the operation at a position where no interference or collision occurs during tuning.

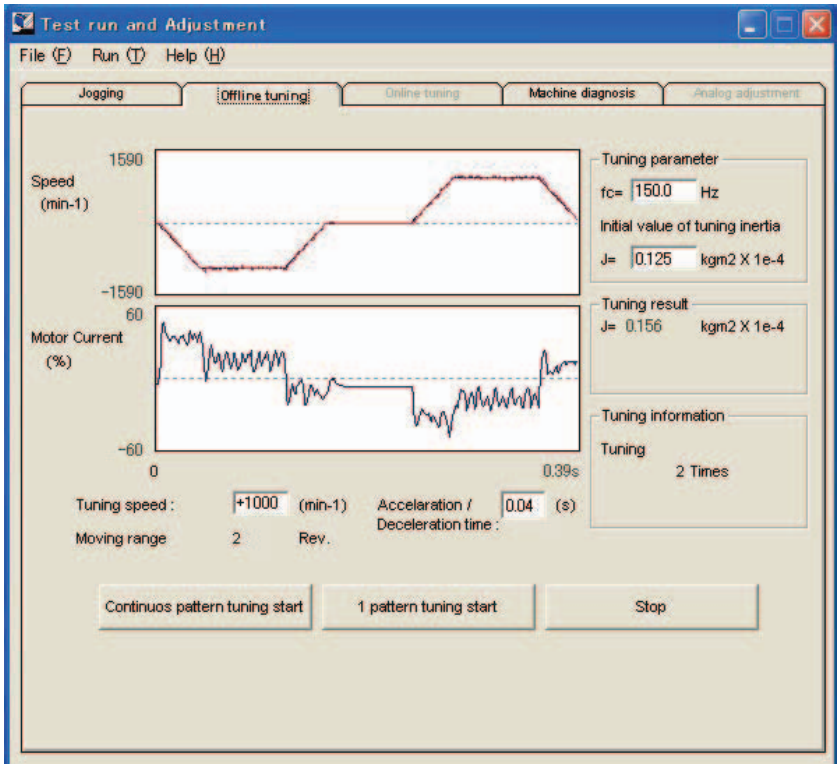
Note 3:When "Linear Motor" is selected, the units are "mm".

3. Click the [Continuous pattern tuning start] button.

4. Check safety conditions and then turn on the FOT and ROT terminals, and turn on the SON terminal. This starts continuous pattern operation and estimates the moment of inertia.

   Note: When a PHASER series robot is used, magnetic pole position finding must be performed before this operation. For information on magnetic pole position finding, refer to the separate "YAMAHA Single-Axis Robot Driver RD Series" user's manual.

5. After estimating the moment of inertia, the last pattern operation waveforms are downloaded from the robot driver and the estimated results displayed as shown below.



6. After tuning ends, turn the SON terminal off, and turn the RS terminal on and then off, to exit the auto-tuning mode.

   Note 1: This function automatically rewrites the "Moment of inertia" (Fd-00) parameter.
   Read the parameters from the robot driver again if the "Parameter setting" window is open.

   Note 2: Even when tuning is interrupted before it is complete, turn the SON terminal off, and turn the RS terminal on and then off, to exit the auto-tuning mode.

(2) Procedure for offline auto-tuning while checking the result each time

1. Click the [Test run and Adjustment] button on the opening screen.
   The "Test run and Adjustment" window appears as shown below.
   Click the [Offline tuning] tab.

2. Set the following parameters that are required for tuning:

(A) Cut-off frequency (fc) setting

Set the cut-off frequency for controlling the speed during auto-tuning. Set a value that will not cause hunting.

(B) Initial value of tuning moment of inertia

Set the moment of inertia at start of auto-tuning. Tuning will end quickly if setting this to a value that you know will roughly match the moment of inertia. If you do not know this value then leave the setting as is. The auto-tuning function will estimate the moment of inertia.

Note 1: When "Linear Motor" is selected, the edit box label is "=m" and the units are "kg×10".

(C) Tuning speed

Enter the speed to use for auto-tuning. If you are sure that the default value does not damage the system including the robot, you can use the default setting.

Note 2: When "Linear Motor" is selected, the edit box label is "Tuning speed" and the units are "mm/s".

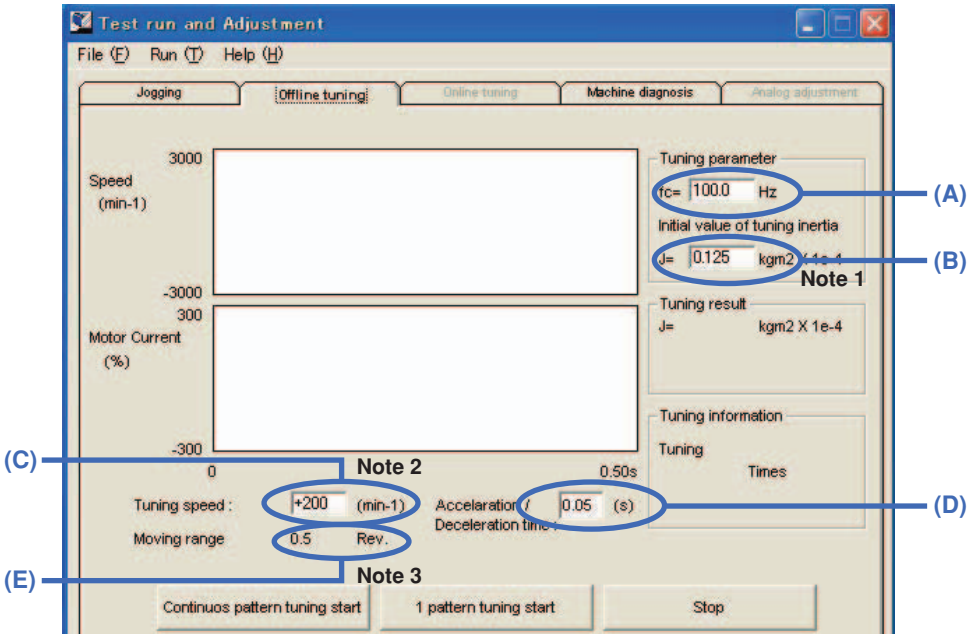
(D) Acceleration/deceleration time

Set an acceleration/deceleration time for pattern operation during auto-tuning. If you are sure that the default value does not damage the system including the robot, you can use the default setting.

(E) Moving range

Displays a general guide for the rotation (distance) amount during auto-tuning. Use the displayed value only for a general guide. Allow the operation at a position where no interference or collision occurs during tuning.

Note 3: When "Linear Motor" is selected, the units are "mm".

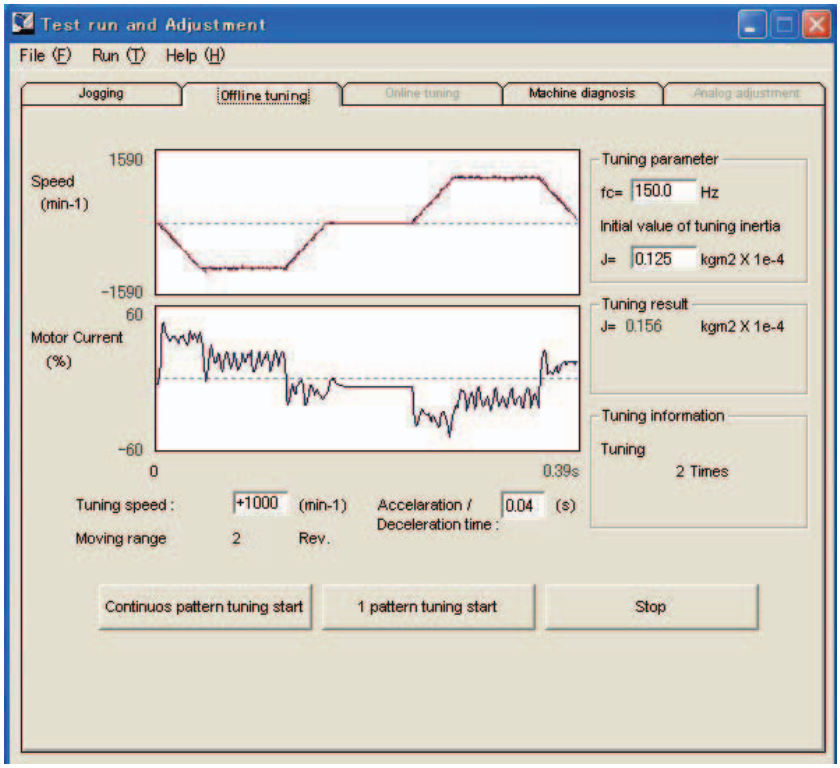


3. Click the [1 pattern tuning start] button.

4. Check safety conditions and then turn on the FOT and ROT terminals, and turn on the SON terminal. This starts 1-pattern operation and estimates the moment of inertia.

   Note: When a PHASER series robot is used, magnetic pole position finding must be performed before this operation. For information on magnetic pole position finding, refer to the separate "YAMAHA Single-Axis Robot Driver RD Series" user's manual.

5. After estimating the moment of inertia, the last pattern operation waveforms are downloaded from the robot driver and the estimated results displayed as shown below.



6. Check if the waveform is satisfactory and click the [1-pattern tuning start] button again if necessary. This runs the 1-pattern operation and estimates the moment of inertia.
   Repeat this to perform tuning while checking one waveform at a time.

7. After tuning ends, turn the SON terminal off, and turn the RS terminal on and then off, to exit the auto-tuning mode.

Note 1: This function automatically rewrites the "Moment of inertia" (Fd-00) parameter.
Read the parameters from the robot driver again if the "Parameter setting" window is open.

Note 2: Even when tuning is interrupted before it is complete, turn the SON terminal off, and turn the RS terminal on and then off, to exit the auto-tuning mode.

3.5.3 Mechanical system diagnostic measurement procedure

Use the following procedure when measuring the resonance point of a robot connected to the robot driver.

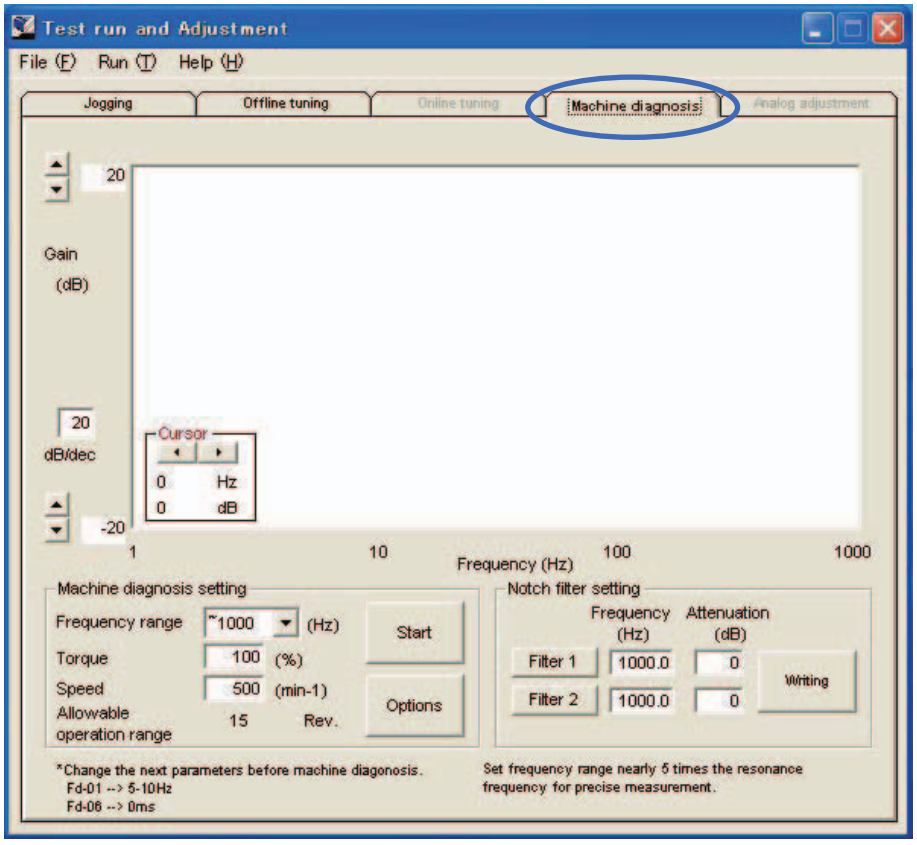
Note: The robot driver parameters are factory set to ensure that the robot operates normally. Use of this function is not required except in cases where robot operation is abnormal, or when adjusting the parameter data.

1. Set up as described below.
   Before starting measurement, open the "Parameter setting" window and set the parameters as shown in the following table.

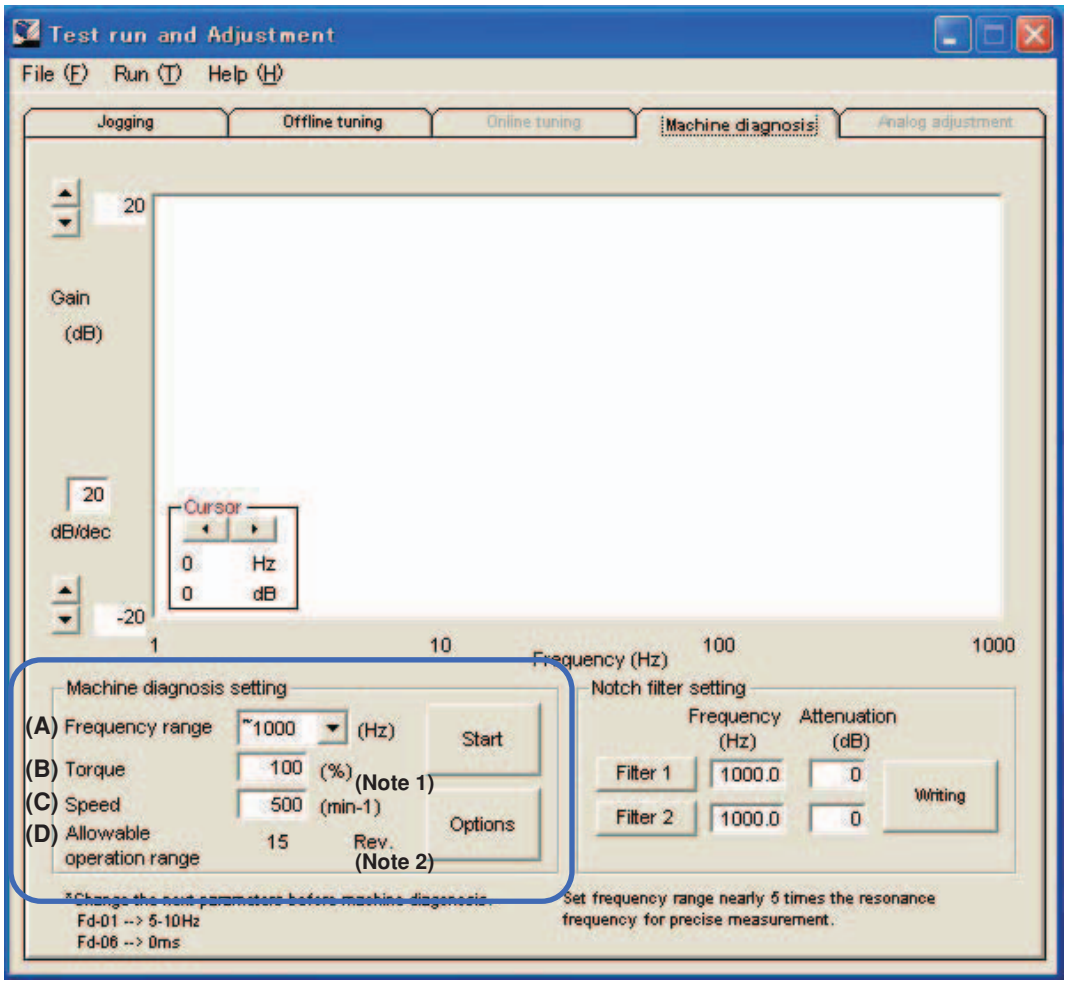
Parameter name	No.	Setting	Initial value
Moment of inertia (Note 1)	Fd-00	Enter an approximate value.	Motor-specific value
Speed control cut-off frequency	Fd-01	5 to 10 Hz	30 Hz
Torque command filter time constant	Fd-06	0 ms	2 ms
Notch filter bandwidth 1	Fd-13	0 dB	0 dB
Notch filter bandwidth 2	Fd-15	0 dB	0 dB

Note 1:This parameter is named "Slider mass" when "Linear Motor" is selected.

2. Click the [Test run and Adjustment] button on the opening screen.
   The "Test run and Adjustment" window then appears as shown below.
   Click the [Machine diagnosis] tab.



3. Enter settings for mechanical system diagnosis.
   Set each item in the "Machine diagnosis setting" group box as described below.



(1)Overall setup

Read the following instructions and check if your machine is in safe condition. If there is no problem, use the default settings for making measurements.

(A) Frequency range

Set the machine resonance frequency measurement range as directed below.

- **If the approximate resonance frequency is already known:**

  Set a frequency range that covers about 5 times the approximate resonance frequency.

- **If an approximate resonance frequency is not known:**

  Select a range of up to 900 Hz.
  After measuring the resonance frequency, set a frequency range that covers about 5 times the measured resonance frequency, and then measure the resonance frequency again to obtain a more accurate result.

(B) Torque

Set the diagnostic signal amplitude during mechanical system diagnostic measurements.
Setting a higher amplitude (100% or less) ensures more accurate measurements. However, the higher the amplitude, the greater the torque applied to the machine, so use caution.

(C) Speed

Operation proceeds at a constant speed during mechanical system diagnosis. Set a speed command to specify the constant speed.
Enter a sufficiently high speed in a range from 100 min^{-1} on up to the rated speed. This speed must remain constant and must cause no machine damage.

Note 1:When "Linear Motor" is selected, the units are "mm/s".

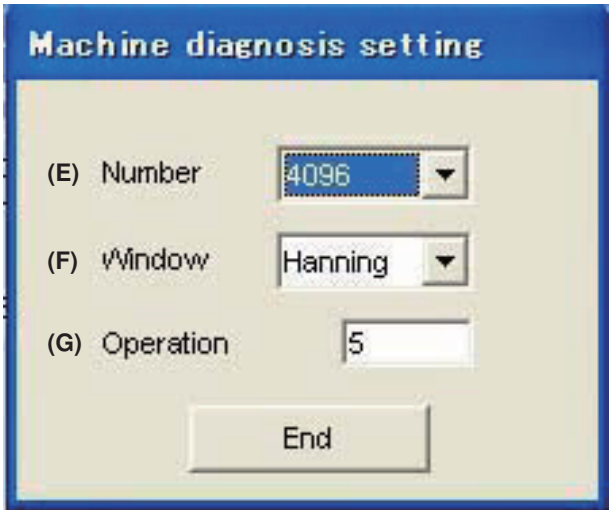
(D) Allowable (allowable operation range)

Displays the allowable distance (amount of rotation) the machine can move during mechanical system diagnosis. The machine immediately stops after mechanical system diagnosis ends, but moves slightly more than the displayed value due to the inertia of the machine. Set a longer distance to allow the machine to move slightly more than the displayed distance (amount of rotation). To do this, decrease the speed command value or reduce the operation adjustment range (see (G) in the detailed setting dialog box).

Note 2:When "Linear Motor" is selected, the units are "mm".

(2) Detailed setting

Clicking the [Options] button opens the following dialog box. Make settings as needed. (You do not have to make these settings under normal conditions.)



(E) Number (number of data points)

Set the number of FFT computation points for mechanical system diagnosis. The larger the number of points, the higher the measurement accuracy, but the longer the time needed uploading data. Using a small number of points for initial rough measurements and then increasing the number of points for final detailed measurements will reduce the measurement time. Basically make measurements using the maximum number of data points (4096).

(F) Window (windowing function)

A windowing function is applied to the data. If it is difficult to see the measured waveform, changing this setting may make it easier to see. You can select from among "Hanning", "Hamming" or "Nothing". Basically make measurements using "Hanning".

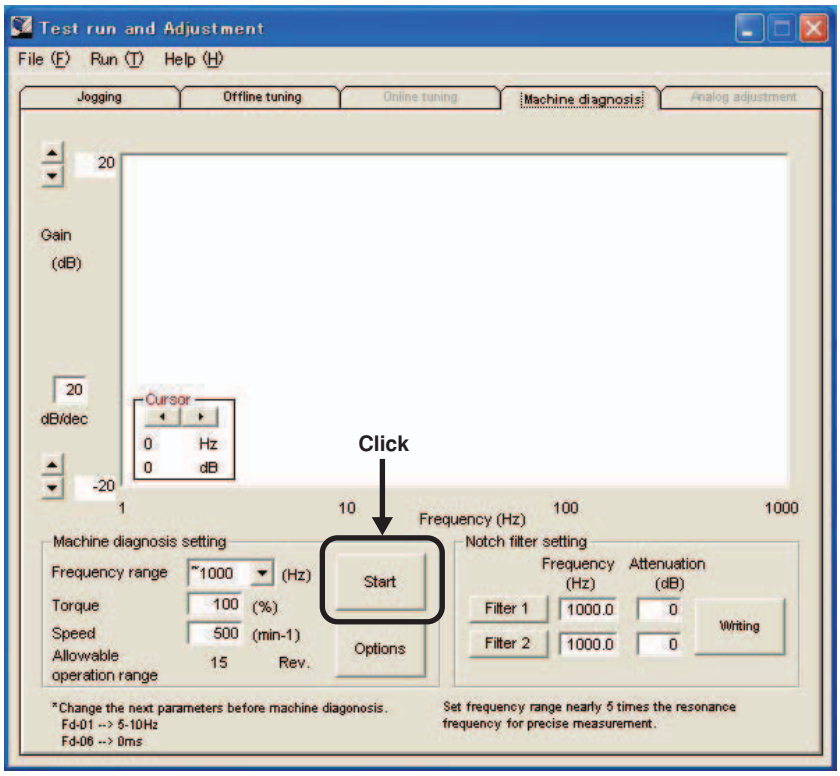
(G) Operation (operation adjustment range)

Reducing this setting narrows the operation range during measurement. But this makes it difficult to see the waveform in a low frequency region. If difficult to see the waveform in a low frequency region in the default setting, then change it to a larger value. Units for this parameter are as follows:

Rotary motor: rotations (number of revolutions)

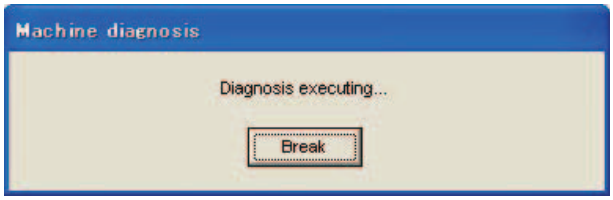
Linear motor: magnetic pole pitch (mechanical length equal to 360° electrical angle)

4. Click the [Start] button to start diagnosis.

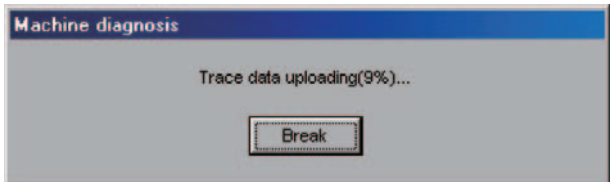


Note: When a PHASER series robot is used, magnetic pole position finding must be performed before this operation. For information on magnetic pole position finding, refer to the separate "YAMAHA Single-Axis Robot Driver RD Series" user's manual.

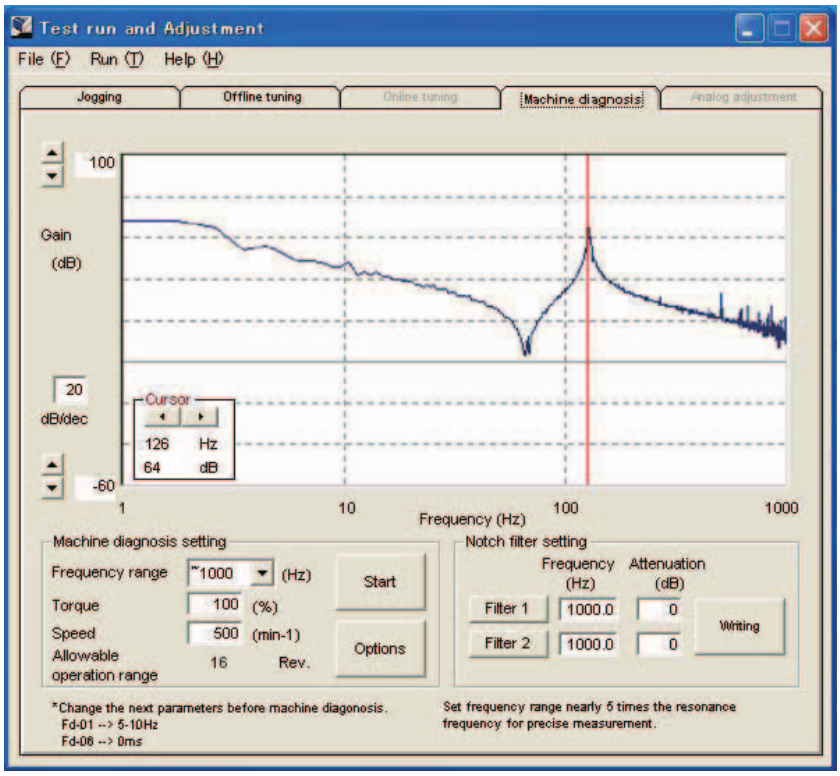
5. Turn on the servo ON (SON) terminal.
   The robot then starts moving.
   If an emergency stop is required, turn off the SON terminal.



6. Data upload begins when this operation ends.



7. Results from mechanical system diagnosis appear as shown below.



8. Turn off the servo ON (SON) terminal, turn the RS terminal on and then back off.

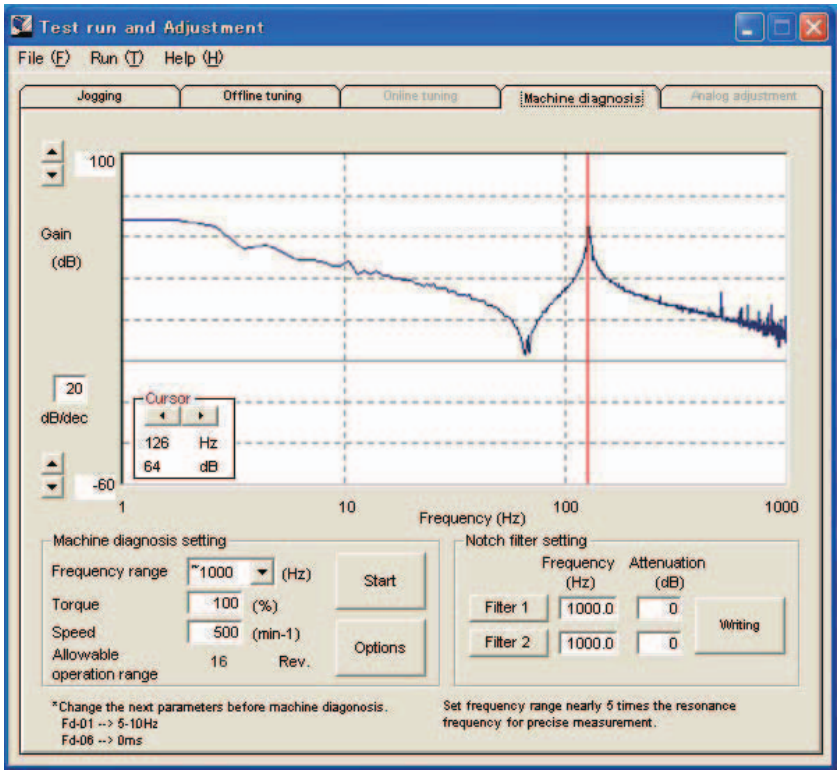
9. Check the waveform to determine whether or not to make measurements again.

When the resonance point is easily seen:

Proceed to the next section 3.5.4, "Notch filter setup procedure".
The waveform shown in step 7 indicates that a relatively clear resonance point was measured. If a clear resonance point like this was not obtained, then make the measurement again as explained next. You might then be able to measure a clear waveform.

If the resonance point is not easily seen:

Change the frequency range (A) explained earlier so that the measurement frequency is 5 times the frequency at the currently estimated resonance point (peak), and then repeat from step 4 until a clear resonance point is obtained. Also change the settings for parameters (B) through (G). The example below shows the waveform measured after changing the settings.

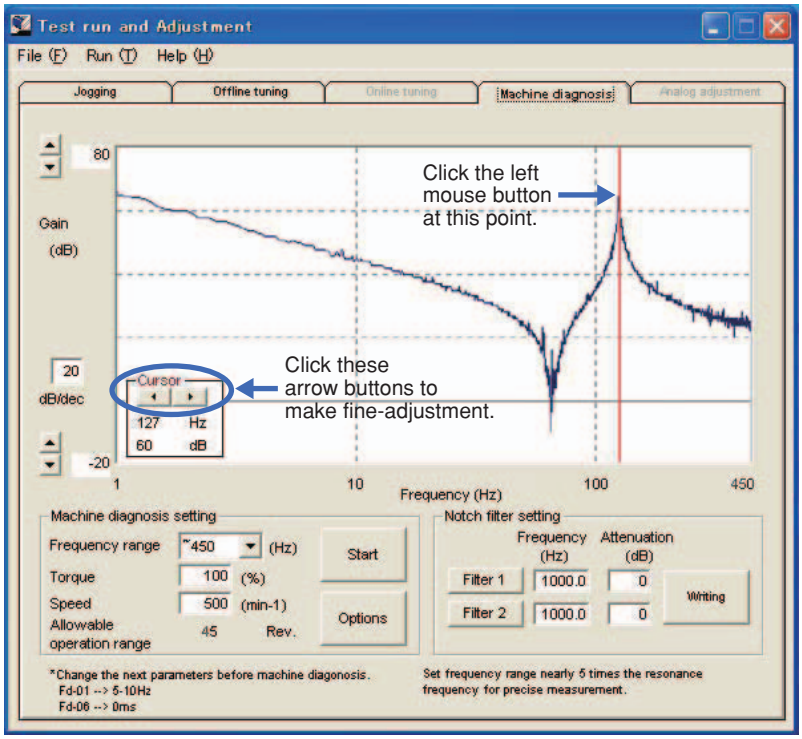


Note: No matter how many times you change the settings, you might still be unable to obtain an easy-to-see waveform depending on your machine. Even in that case, there is no real problem as long as the resonance point (peak) is measured.

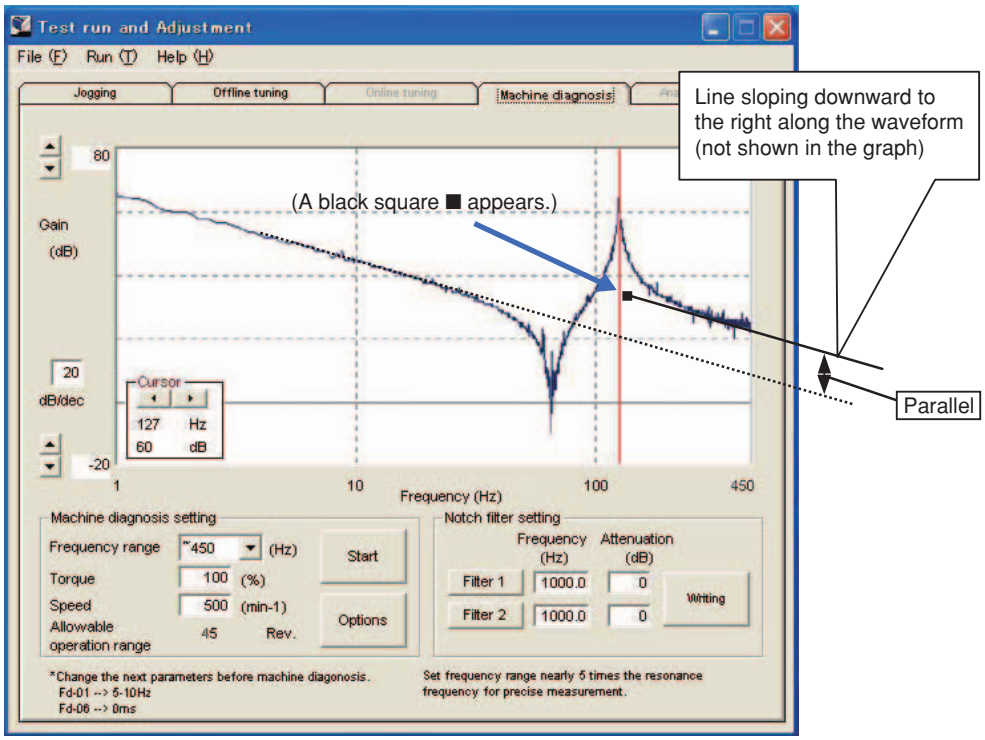
3.5.4 Notch filter setup procedure

Use the following procedure to set the notch filter parameters (Fd-12 to Fd15).
(You need to first measure the resonance point as described in the preceding section.)

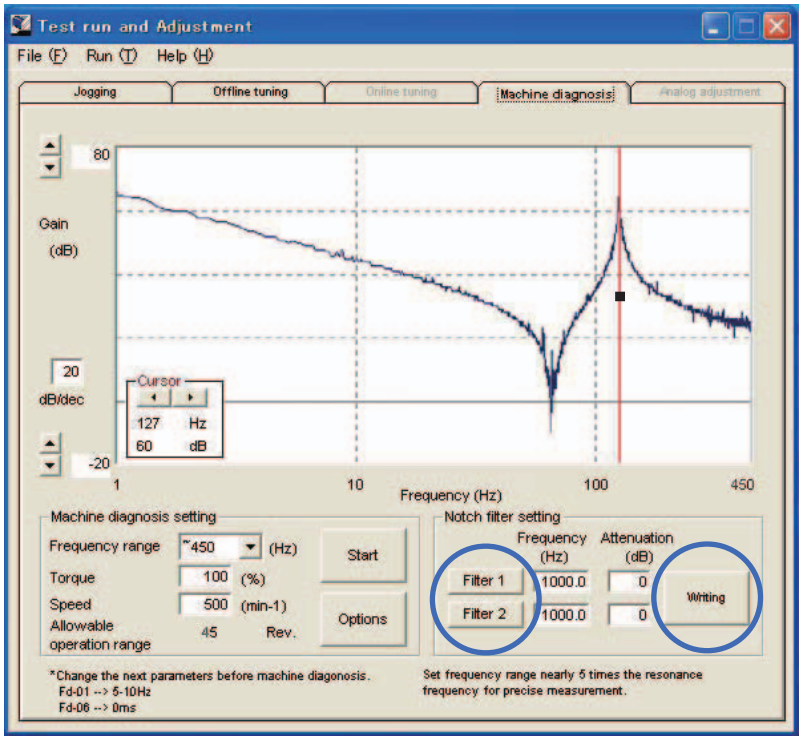
1. Left-click the mouse at the resonance point (peak) of the waveform displayed on the [Mechanical diagnosis] tab screen. Use the arrow buttons on the left side to fine-adjust the cursor line so it lies along the peak point as shown.



2 Right-click the mouse at the intersection of the cursor line aligned with the peak point and the straight line sloping downward to the right along the waveform.



3. Click the [Filter 1] button. The recommended settings then appear in the boxes to the right of the button you clicked.



4. You can set up to 2 resonance frequencies. If there is another resonance point, repeat from step 1 and make the setting with the [Filter 2] button.

Note: If two resonance points are close to each other, then robot operation might become unstable even when the filters are set correctly. In this case, set the resonance point that is clearer.

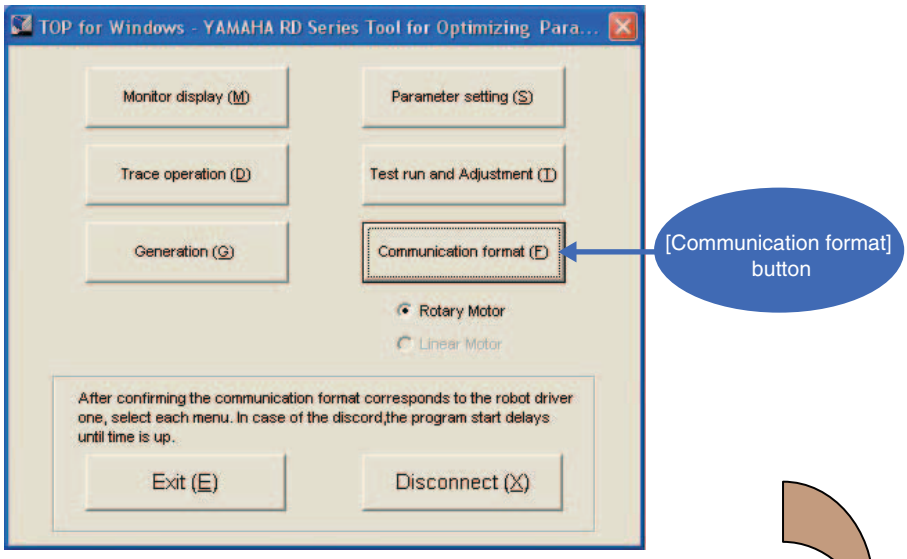
5. Click the [Writing] button. The settings for Fd 12 to Fd-15 are then transferred to the robot driver.

6. Return the gain and other settings to their previous values, and then start operation to check whether vibration is reduced. If vibration is not significantly reduced, slightly change the "Notch filter frequency" parameters (Fd-12, Fd-14) to locate a point where vibration is reduced. The notch filter function might work more effectively if you adjust the "Notch filter bandwidth" parameters (Fd-13, Fd-15).

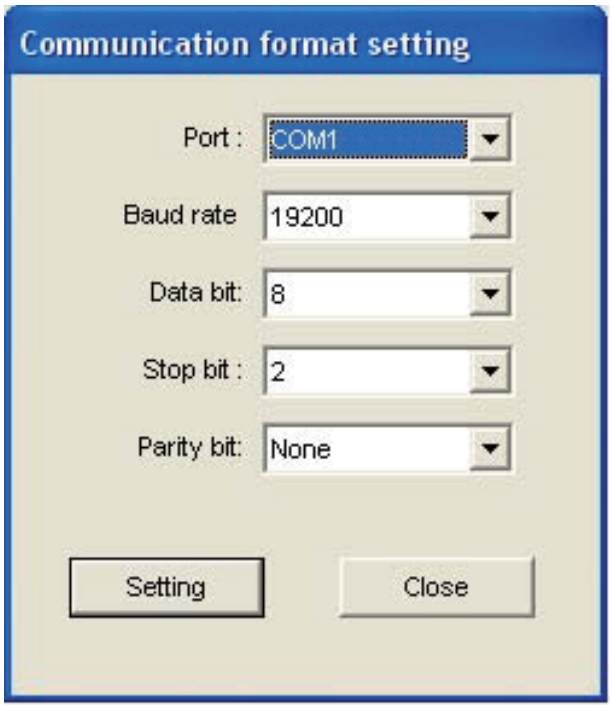
Note: Mechanical diagnostic measurements are to be used only as a guide. The measured resonance frequency might deviate slightly from the correct frequency.

3.6 Changing the communication format

1. Click the [Communication format] button on the opening screen.


TOP for Windows - YAMAHA RD Series Tool for Optimizing Para...
Monitor display (M)
Parameter setting (S)
Trace operation (D)
Test run and Adjustment (T)
Generation (G)
Communication format (F)
[Communication format] button
Rotary Motor
Linear Motor
After confirming the communication format corresponds to the robot driver one, select each menu. In case of the discord,the program start delays until time is up.
Exit (E)
Disconnect (X)

2. When the following dialog box appears, make the necessary changes.



3. After making the necessary changes, click either of the following buttons depending on the situation:

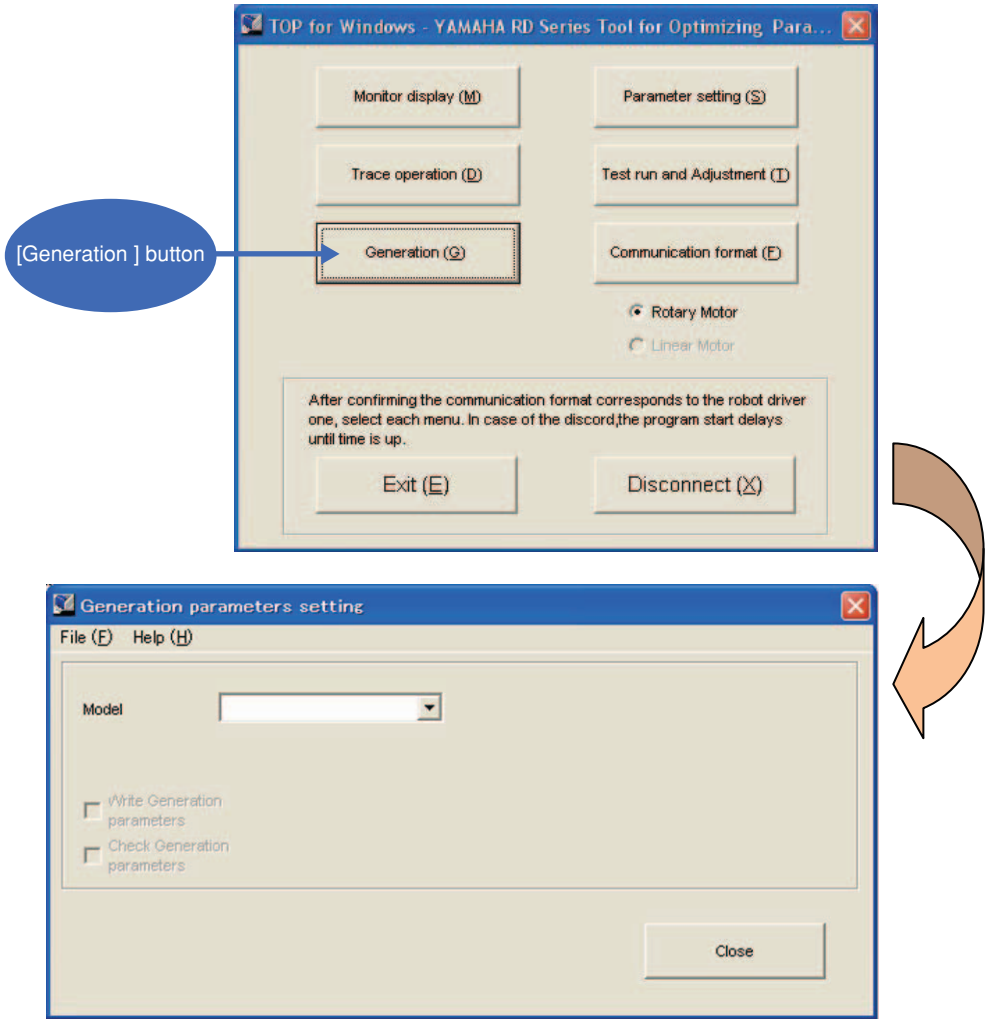
[Setting] button: Changes the settings for both the robot driver and PC if they are connected and then reconnect them.
Changes settings only for the PC when the robot driver is not connected to the PC.

[Close] button: Closes the "Communication format setting" dialog box.

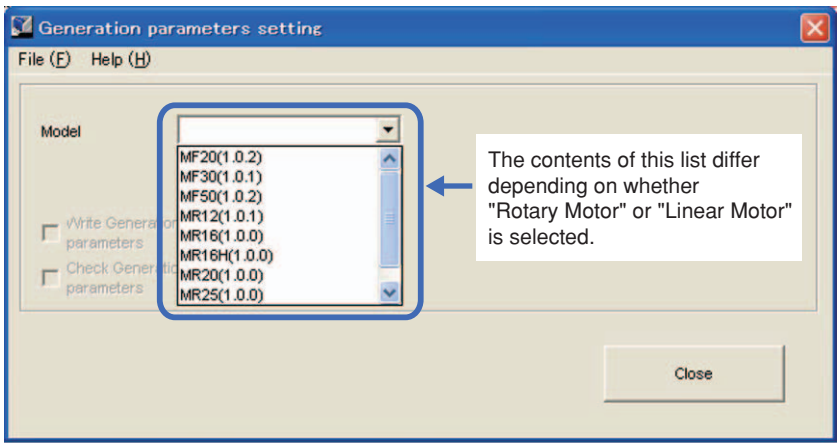
3.7 Generation setup

This function returns all robot driver parameters to the robot's initial parameter data.

1. After connecting the robot driver, turn the robot servos OFF, then press the [Generation (G)] button at the opening screen.
   Make setups as described next.


[Generation] button
TOP for Windows - YAMAHA RD Series Tool for Optimizing Para...
Monitor display (M)
Parameter setting (S)
Trace operation (D)
Test run and Adjustment (T)
Generation (G)
Communication format (F)
Rotary Motor
Linear Motor
After confirming the communication format corresponds to the robot driver one, select each menu. In case of the discord,the program start delays until time is up.
Exit (E)
Disconnect (X)
Generation parameters setting
File (F) Help (H)
Model
Write Generation parameters
Check Generation parameters
Close

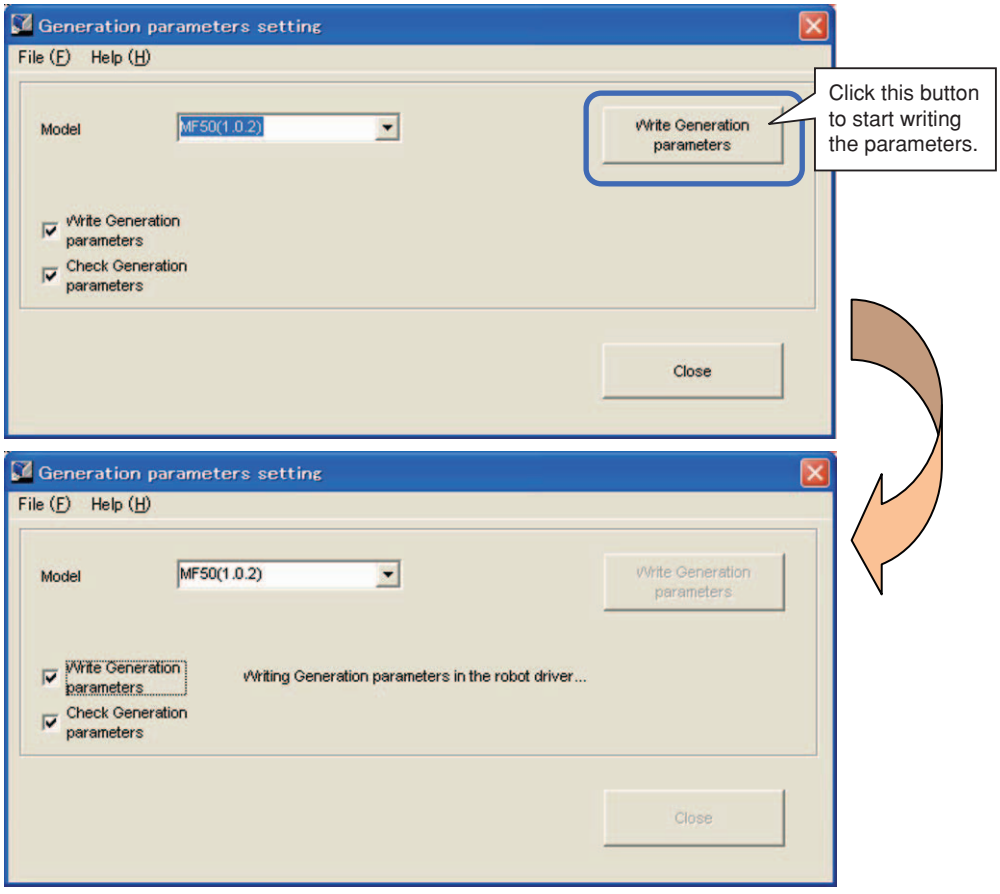
2. Select the robot model number from the "Model" drop-down list. Generation data on robots incompatible with the robot driver cannot be written.



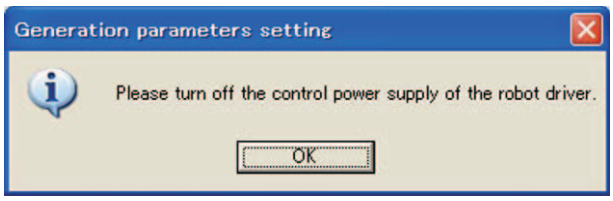
Note 1: If the robot you are using is not in the list, you must add it to the generation models. See Appendix 5.3, "Adding a generation model".

Note 2: Be sure to select the model to be used.
Performing generation at the wrong model could result in robot malfunctions, and possible damage.

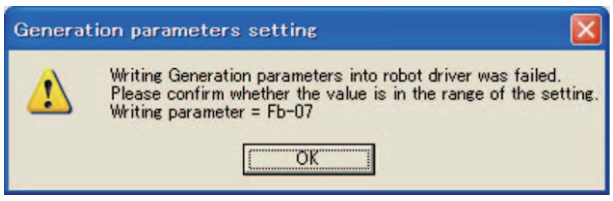
3. Click the [Write Generation parameters] button.
The generation parameters are written and then checked.
You can run one of those tasks by selecting the check box on the lower left.



4. The following message appears when generation setup ended normally.
   Before starting operation, you must turn the power off and then back on again. Click the [OK] button to close this message.



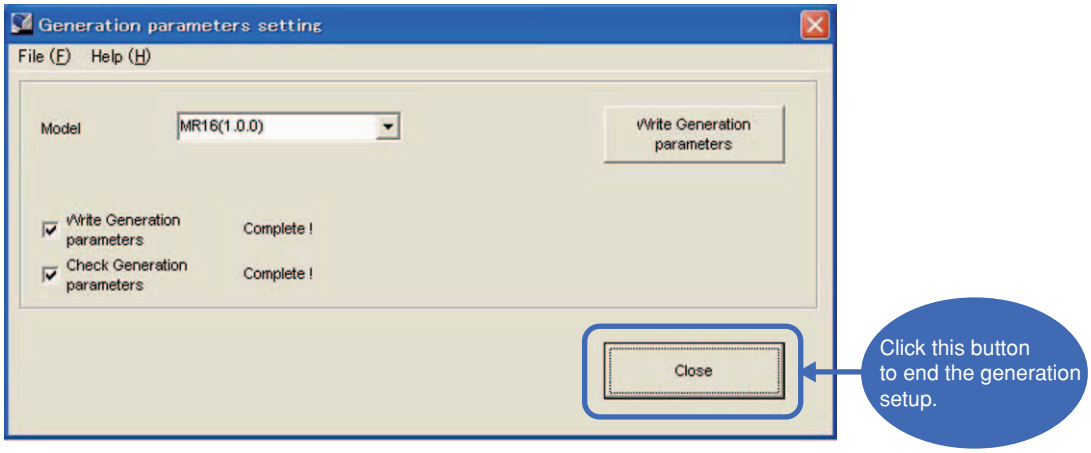
Note: If an error occurs while the parameters are being written, the following error message displays.


Generation parameters setting
Writing Generation parameters into robot driver was failed.
Please confirm whether the value is in the range of the setting.
Writing parameter = Fb-07
OK

Error message example

As directed by the error message, verify the robot model number and the parameter settings, then execute the writing operation again.

5. Click the [Close] button to end the generation setup.



Note: Never shut off the robot driver's control power while the parameters are being written. This could damage the robot driver's internal EEPROM data (saved data), possibly resulting in malfunctions.

Chapter 4 Troubleshooting Guide

This chapter explains how to troubleshoot problems or errors that might occur during operation of this product.

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4.2 If failed to write parameters 4-1
4.3 If failed to load parameters 4-2
4.4 If failed to initialize parameters 4-2
4.5 If operation trace does not run correctly 4-2

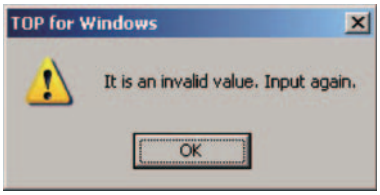
4. Troubleshooting guide

4.1 If failed to connect to the robot driver

If the PC cannot connect to the robot driver, check the following possible causes and correct the problem.

Possible cause	Action
A wrong connector is used for connecting the robot driver to the PC.	Check the connector and use a correct connector.
The connection cable is not securely connected or in poor contact.	Check the cable connection and securely connect the cable.
The robot driver and PC baud rates do not match.	Check the baud rate, etc. Correct the PC or robot driver settings as needed.
The RS-232C port (COM) setting is incorrect. (Check the COM port number by opening the "Control Panel" – "Device Manager".)	Check the COM port setting on the PC, and then set the correct COM port number in the "Communication format setting" dialog box on the TOP software.

4.2 If failed to write parameters



If the above message appears, click the [OK] button and then check the following possible causes to correct the problem.

Possible cause	Action
An attempt was made to change a write-prohibited parameter during operation with the SON terminal turned on.	Turn off the SON terminal and write the parameter.
An attempt was made to write parameter data that was outside the allowable range.	Write parameter data that is within the allowable range.

4.3 If failed to load parameters

If parameters cannot be loaded, check the following cause and correct the problem.

Possible cause	Action
The connection cable between the PC and robot driver is not securely connected or is broken.	Check and correct the cable connection or wire breakage and then load the parameters again.

4.4 If failed to initialize parameters

Possible cause	Action
Parameters could not be loaded after initialization.	Check whether the digital operator on the robot driver displays the initialization progress. Load the parameters again.
The connection cable between the PC and robot driver is not securely connected or is broken.	Check and correct the cable connection or wire breakage and then initialize the parameters again.

4.5 If operation trace does not run correctly

If operation trace does not run correctly, check the following possible cause and correct the problem.

Possible cause	Action
Operation was not triggered due to improper trigger conditions.	Correct the trigger conditions.

Chapter 5 Appendix

Contents

5. Appendix 5-1

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5.2.1 Connection procedures and precautions 5-3

5.3 Adding a generation model 5-5

5. Appendix

5.1 Files copied to system

The table below lists the names of files that are copied to the c:\windows\system directory when you install the TOP software (assuming that Windows is installed on drive C).

OCX files	COMDLG32.OCX
	MSCOMCT2.OCX
	MSCOMCTL.OCX
	TABCTL32.OCX
	PDQCOM32.OCX
	MSFLXGRD.OCX
	VSVIEW3.OCX
	VSFLEX6D.OCX
	ACSGRAPH.OCX
DLL files	MSVBVM60.DLL
	OLEAUT32.DLL
	ASYCFILT.DLL
	CMDLGJP.DLL
	COMCAT.DLL
	MSCC2JP.DLL
	MSCMCJP.DLL
	OLEPRO32.DLL
	TABCTJP.DLL
	VB6JP.DLL
	STRFMT.DLL
	FLXGDJP.DLL
	MSVCRT.DLL
	VB6STKIT.DLL
	MFC42.DLL

5.2 Connection to a PC with no serial port (RS-232C)

When running the TOP software on a PC with no RS-232C port and connecting the PC to the RD series robot driver, you may use the following PC card or USB-serial converter. Use these devices at your own risk.

< PC card >

Product name	PC Card Standard Type II RS-232C PC Card
Manufacturer	RATOC Systems
Type No.	REX-5056V
Accessory	9-pin D-sub (male) cable (50 cm)

< USB-serial converter >

Product name	USB Serial Converter
Manufacturer	RATOC Systems
Type No.	REX-USB60
Connector	USB (type A)
OS	Windows XP, Windows 2000, Windows 98 SE

For detailed information, you can access RATOC Systems website: http://www.rexpccard.co.jp

Operation under different software usage conditions such as effects due to the installation environment at the site or different PC types has not been confirmed. Usage under such conditions is the responsibility of the customer.

5.2.1 Connection procedures and precautions

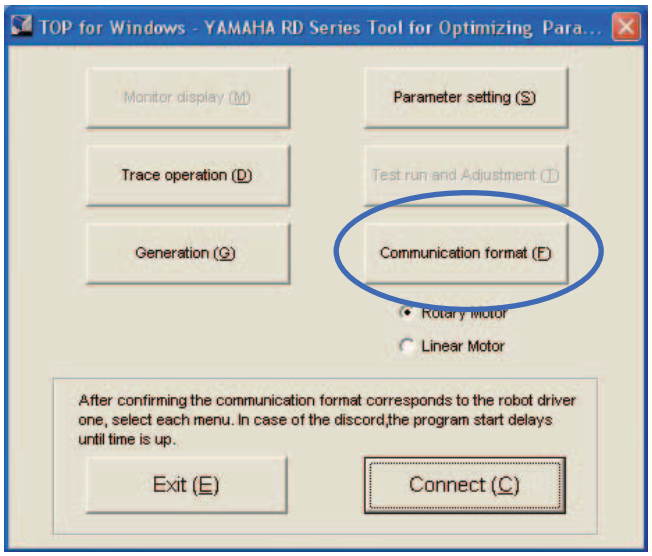
(1)Installing the PC card

Install the PC card by following the instructions in the manual that came supplied with it. At this time, be sure to note which COM port the PC card RS-232C is assigned to.

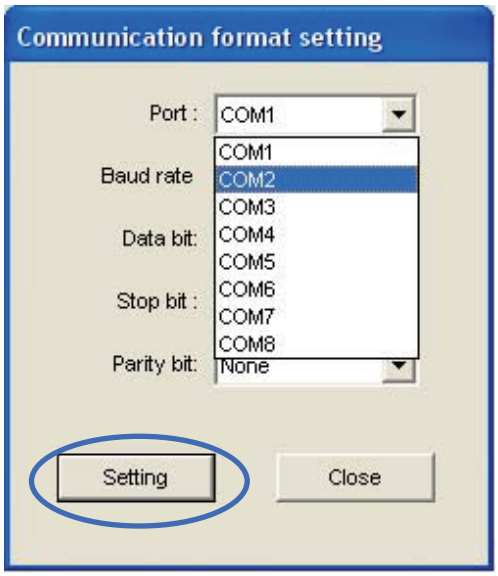
(2)Connecting the TOP software

When you first start the TOP software after installing it, the communication port is set to COM 1, so change it to the above-noted COM port and make the connection as explained below. (The following example assumes that the PC card RS-232C is assigned to COM2.)

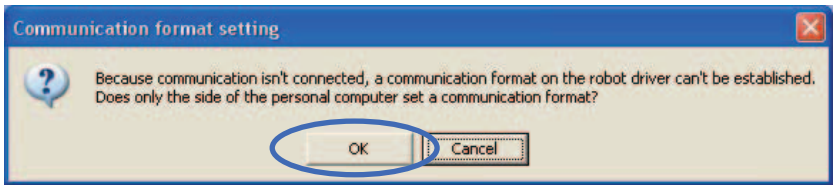
1. Start the TOP software.
2. Click the [Communication format] button.The "Communication format setting" dialog box appears.
3. Set the communication port to COM2.


TOP for Windows - YAMAHA RD Series Tool for Optimizing Para...
Monitor display (M)
Parameter setting (S)
Trace operation (D)
Test run and Adjustment (T)
Generation (G)
Communication format (F)
Rotary Motor
Linear Motor
After confirming the communication format corresponds to the robot driver one, select each menu. In case of the discord,the program start delays until time is up.
Exit (E)
Connect (C)

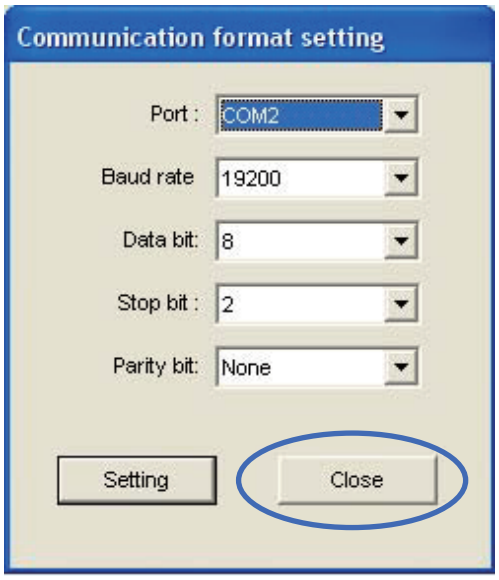
4. Click the [Setting] button.



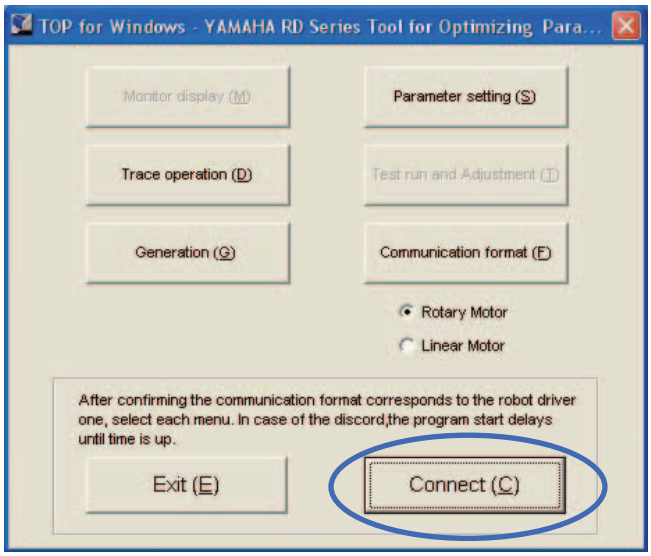
5. When the following dialog box appears, click the [OK] button.


Communication format setting
Because communication isn't connected, a communication format on the robot driver can't be established.
Does only the side of the personal computer set a communication format?
OK
Cancel

6. Click the [Close] button.



7. Connect the PC card RS-232C cable to the robot driver connection cable and then click the [Connect] button to make the connection.


TOP for Windows - YAMAHA RD Series Tool for Optimizing Para...
Monitor display (M)
Parameter setting (S)
Trace operation (D)
Test run and Adjustment (T)
Generation (G)
Communication format (F)
Rotary Motor
Linear Motor
After confirming the communication format corresponds to the robot driver one, select each menu. In case of the discord,the program start delays until time is up.
Exit (E)
Connect (C)

If the connection is not properly made, check the COM port assigned to the PC card and the communication baud rate, data bit, stop bit and parity settings for the robot driver. Check that the PC settings match those on the robot driver, and then retry the connection.
You do not have to repeat the above procedure unless you reinstalled the TOP software. From the next time onward, just click the [Connect] button to make the connection after starting the TOP software.

5.3 Adding a generation model

If the robot you are using is not found in the generation setup list, then you must add it as a generation model, In that case, please contact us in advance to obtain the correct generation data file that matches the robot you want to add as a generation model.

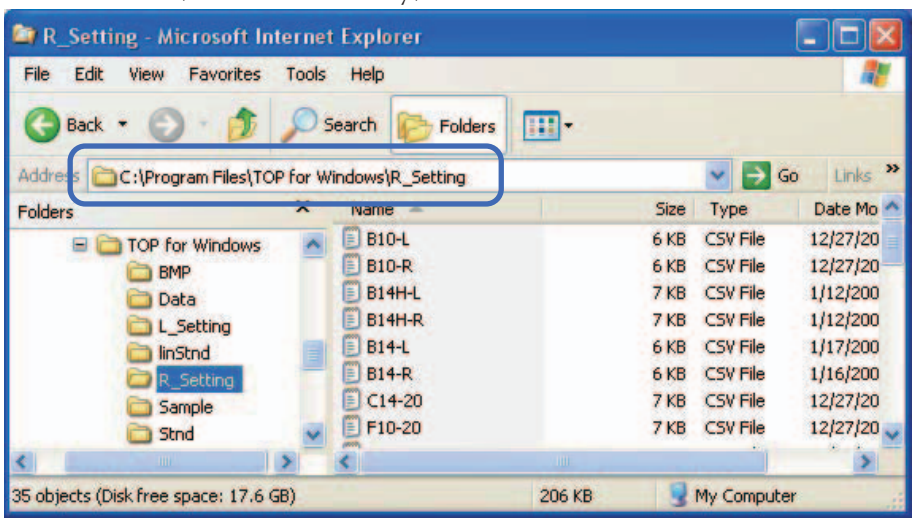
To add a generation model, follow these steps.

1. Exit the TOP software if it is running.
2. Copy the generation data file onto the following folder by using the Windows Explorer, etc.

   When the robot driver is for a rotary motor:

   "Directory (where TOP is installed)"\R_Setting

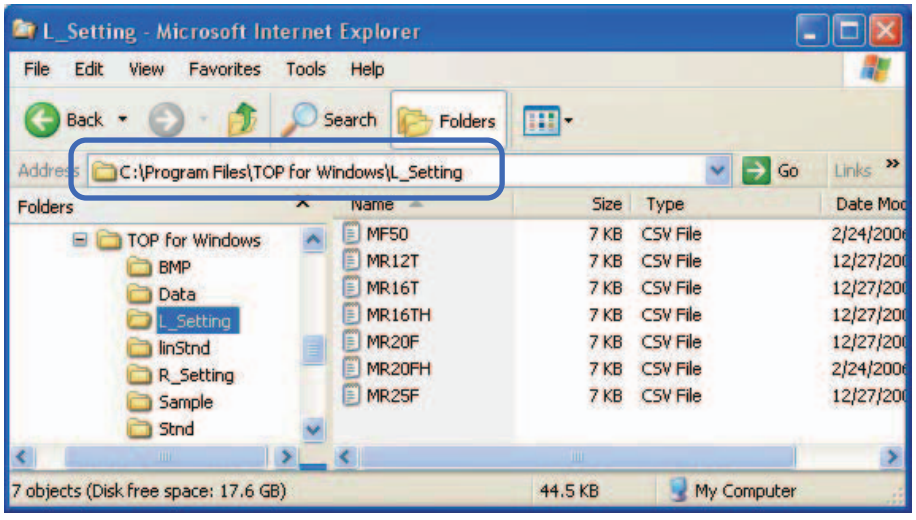
   Example: When the TOP software is installed in "C:\Program Files\TOP for Windows (default directory)



   When the robot driver is for a linear motor:

   "Directory (where TOP is installed)"\L_Setting

   Example: When the TOP software is installed in "C:\Program Files\TOP for Windows (default directory)



3. Start the TOP software, and you can then select the added robot model from the generation setup list.

MEMO

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Revision record

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Ver. 1.00	Feb. 2007	English manual Ver. 1.00 is based on Japanese manual Ver. 1.02.
Ver. 1.01	Oct. 2007	English manual Ver. 1.01 is based on Japanese manual Ver. 1.03.
Ver. 1.02	May 2008	English manual Ver. 1.02 is based on Japanese manual Ver. 1.04.
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User's Manual

Tool for Optimizing Parameters RD series

YAMAHA Robot Driver TOP

Jul. 2008
Ver. 1.03
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